WHAT WE EAT.

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WHAT WE EAT:

AN ACCOUNT OF THE MOST COMMON ADULTERATIONS OF FOOD AND DRINK.

WITH

SIMPLE TESTS BY WHICH MANY OF THEM MAY BE DETECTED.

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BOSTON:
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PREFACE.

The practice of adulterating alimentary articles with substances either worthless or injurious, for the purpose of gain, has prevailed extensively in Europe and especially in England for a long time. Many years ago, the attention of the public in that country was called to the subject by Accum, in his book entitled "Death in the Pot," and the startling revelations which he made attracted for a time great attention. Nothing was done however to arrest the evil, which, extending wonderfully by the aid of capital, and reinforced by the appliances of chemistry and the teachings of knavish experience, has become at last so enormous as to call imperatively for governmental interference, to protect the lives and pockets of the public.

This abuse, so profitable, as might be expected, has not failed to find imitators in this country, who are not far behind their English compeers

either in roguery or skill. Occasional articles in the newspapers, in different parts of the country, though usually dealing with a few isolated cases, have not failed to excite an uneasiness in the public mind, which leads them to seek more extended and accurate information. This it has been my object in the following pages to furnish.

While the public have an unquestionable right to demand the protection of the government from frauds of the adulterators of food, it is a characteristic of the American people, which particularly distinguishes them from European nations, that what they can properly do for themselves, they do not wait for the government to take the lead in. For the purpose of adding something to the means of self-protection, I have endeavored to furnish simple directions, by which many of the more dangerous frauds in food may be detected and avoided. In pickles, confectionery, tea, coffee, and especially in milk, I believe that I have placed it in the power of every one to protect himself from the dangers and losses consequent upon these adulterations. In a letter received by me, a few days since, from that most distinguished friend of sanitary science, Dr. John H. Griscom, of New York, he informs me that all attempts to obtain enactments for the suppression of the horrible distillery

milk-stables have entirely failed. The general introduction, into provision-stores and families, of the simple milk-essayer or lactometer, described in chap. vii., would make the continuance of this fraud impossible, and abolish the evil without the aid of a supine or venal government.

Where convenient tests fail, it is best to follow the advice of the counterfeit bank-note detectors, and reject all of that issue. This has been done, in some parts of the country, on an extensive scale, particularly in regard to green teas, the use of which, in New England, is extremely limited in comparison with their consumption a few years ago. A course like this on the part of the public, coupled with a general willingness to give a fair price for good articles, will, perhaps, accomplish as much or more good than even the best legal enactments.

A portion of the matter which this book contains has been previously published in a series of articles which the author contributed during the past summer to the columns of the "Boston Courier." The general interest which the subject appeared to excite, has induced the publisher to present them to the public in this very much enlarged and more permanent form. The chapters upon the adulteration of milk, and of wines and liquors, are entirely

new, — those subjects not having been discussed in the Courier articles. It is perhaps proper to mention that all of the positive statements which I have made in relation to adulterations, have been verified by a series of careful and often repeated experiments; and although I have not, for reasons which I have given, deemed it proper to pursue the course which has been elsewhere followed, of publishing the names of guilty parties, no less care has been taken on that account to avoid unjust and sweeping assertions. With no little labor, samples of every article upon which I have commented have been subjected to numerous examinations, both microscopic and chemical, and I have endeavored to do justice as strictly as though liable to a severe legal responsibility. I am conscious that I have fallen very far short of exhausting the subject; and doubtless many adulterations and frauds may be known to exist, of which I have made no mention, simply because they have not come in my way. I should be glad if some one, of greater ability and with more time at his disposal, would direct his attention to a subject which all must feel to be of immense consequence to the community.

T. H. H.

69 Shawmut Avenue,
Boston, Dec. 1, 1860.

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WHAT WE EAT.

CHAPTER I.

PRELIMINARY REMARKS. — FRAUDS IN FLOUR AND BREAD.

It is generally but vaguely believed, that frauds are constantly and systematically practised among us, by the sophistication of nearly every article of diet; and that not a few of those engaged in these nefarious practices, in the recklessness of an unhallowed lust for gain, do not scruple to make use of the most deleterious and even poisonous substances for such purposes.

It is a mournful fact that this public uneasiness upon so vital a matter should be well-founded, but it *is* a fact; and in this and succeeding chapters it is designed to give it the point and force of a demonstrated certainty; that the public mind may be aroused to the full enormity of such acts, and to the necessity of an effectual remedy. To this end numerous samples of all the substances which are

in most common use as articles of food, have been carefully and repeatedly examined and tested, by means of the appliances known to science, and the results which will be laid before the reader, cannot fail to produce conviction.

Many of the tests are such, that the statements which will be made can be verified by every one, with but little trouble; others are somewhat recondite and complicated, and require the aid of a more or less extensive apparatus, and a certain amount of experience and skill; but in every case, so far as practicable, the processes will be explained, and simplified to as great an extent as is consistent with that accuracy which is essential to trustworthy results.

Modern science has been furnished, in investigations of this character, with a most powerful auxiliary in the microscope, the wonderful power of which, in the discrimination of minute organic forms, reaches into a field where, before, the greatest powers of the chemist's armory of tests and reagents afforded but a feeble and uncertain guide.

It was for a long time the fashion, even among men of acknowledged attainments in science, to depreciate the microscope, as an aid to chemistry, and to characterize its teachings as valueless and deceptive. Doubtless this opinion, in the infancy of the

instrument, had some slight foundation to rest upon; but the labors of such men as Ehrenberg, Edwards, Schlieden, Nachet, Ross, Lister, Quekett, Carpenter, Spencer, and many others, who have devoted their time and talents to the improvement of the instrument, and to a careful study of all the sources of error either from optical or mechanical causes, make all such reflections obsolete and absurd; and the microscope takes its place unquestioned, as indispensable in every chemical investigation. By its aid, not only are the primitive organic forms, so delicate and so easily changed and destroyed by any of the ordinary appliances of chemistry, pointed out and recognized under almost every circumstance, without the possibility of error; but minute portions of metals, minerals, and salts, so infinitesimal as to be quite beyond the touch of any test that can be applied, under the naked eye, are unerringly designated, either by the forms of their microscopic yet still characteristic crystals, or by definitive changes, under equally minute quantities of the proper reagents, that would be otherwise totally inappreciable.

For the systematic application of the microscope to the detection of adulterations of food, we are unquestionably indebted to Dr. Arthur Hill Hassall of London. It is interesting and instructive to note how completely ignorant of its powers for this pur-

pose, until instructed by him, were men of even scientific distinction; and still more those officials whose duty it was, in the service of the English revenue, to ferret out many of the frauds of this nature, which were yet constantly, and with entire impunity, practised under their very eyes. As an instance, in 1850 the chancellor of the British Exchequer stated in the House of Commons, that, neither by chemistry, nor by any other means, was the adulteration of coffee with chicory to be detected. This statement (I quote Dr. Hassall) was made on the strength of a report, procured at the instance of the Excise, from three of the most distinguished chemists of the day: the real fact at the same time being, that nothing is more easy or certain than the discovery of the adulteration in question, by means of the microscope.

By uniting then, the now unquestioned powers of this instrument, with the other well-known resources of chemistry, but few of the numerous frauds practised by dealers in food can escape recognition.

I do not propose to make, in this manual, nor should the public in their dealings make, any compromises with those who are engaged in this business of depreciating and defiling our daily food. It is sometimes said, that if they would not poison us, we could put up with being cheated. But they

have no more right to cheat us than they have to poison. When we buy and pay for an article, we have a right to that article in its purity, and not adulterated with ten, twenty, or fifty per cent. of another inferior or entirely worthless substance. The excuse is often made, that the public demand goods so cheap in price that it is impossible to furnish them of the proper quality. But this is not so. Let it be fully understood that when a purchaser buys an article at eight cents a pound which cannot be honestly sold at less than ten cents, he is really getting no more, and generally less for his money at the last than first price, the balance being made up of something useless at best, if not positively injurious, and there is no man in his senses who would not take the genuine article.

This practice of adulteration originates with dishonest men, who take this means to undersell their more honest neighbors in the same business; and it is as much for the interest of dealers who prize integrity and fair dealing, to lend their aid to the suppression of such frauds, as it is for the interest of the public at large. Doubtless many men whose souls revolt at such acts, yet feel themselves compelled by the pressure of this dishonest competition to resort to a similar course. These men should hail with joy every effort to enforce and reinforce the laws which must be their as well as our best protec-

tion; and as in this country public officials require the support of public sentiment before they can act effectually, they should join us in our attempts to arouse and direct that sentiment aright.

When we come to examine the list of adulterated articles of food, we are surprised at its extent. Nothing seems to have escaped which is not in its nature insusceptible of vitiation. Bread and butter, tea, coffee, cocoa, sugar, milk, spices, confectionary, preserved fruits and meats, vinegar, pickles, oils, wines, and liquors, almost every article which we find upon our tables — bear upon them the trail of the serpent, in the form of such delectable substances as salts of copper and arsenic, the chromate, oxide, acetate and carbonate of lead, bi-sulphuret of mercury, gamboge, chromate of potash, Prussian blue, Brunswick green, catechu, alum, indigo, sulphuric acid, Venetian red, yellow ochre, bronze powders; to say nothing of less injurious, though not less dishonest, additions, of plaster of Paris, chalk, starch, burnt peas, beans, rye and chicory, water, turmeric, lard, meal, potatoes, etc. All of these articles, and not a few others of the same kind, shall be demonstrated to exist in the food consumed daily by the people of this country. The more poisonous substances are usually found in minute, though by no means homœopathic quantities, but this makes them only the more deadly, be-

cause it admits of their constant and undetected use, until the constitutions of the victims are fatally undermined. Sometimes, however, immediately serious and even fatal results occur, and we not uncommonly see accounts of the death of children, especially from the use of colored confectionary. How many attacks of "colic," "vomiting," "dysentery," "sick headache," how much "nervousness," "blindness," "deafness," "dyspepsia," or even paralysis and insanity, might be traced by rigorous investigation to such sources it is frightful to think of.

Dr. Hassall, in his most admirable work on Adulterations Detected in Food and Medicine, makes the following remarks upon this point:—

"Now with evidence such as the above, it is impossible to contend that the use of such a variety of injurious, and even poisonous, substances is unattended with danger, and that adulteration does not affect the public health. It may so happen, and it doubtless does sometimes occur, that the same person, in the course of a single day, receives into his stomach some eight or ten of the articles above enumerated. Thus with the potted meats and fish, anchovies, red sauces, or cayenne, taken at breakfast, he would consume more or less bole Armenian, Venetian red, red lead, or even bi-sulphuret of mercury. At dinner with his curry or cayenne, he would run the chances of a second dose of lead or

mercury; with the pickles, bottled fruit, and vegetables, he would be nearly sure to have copper administered to him; while if he partook of *bon bons* at dessert, there is no telling what number of poisonous pigments he might consume. Again, in his tea, of mixed or green, he would certainly not escape without the administration of a little Prussian blue, and, it might be, worse things; if he were a snuff-taker, he would be pretty sure to be putting up his nostrils, from time to time, small quantities of either some ferruginous earth, bi-chromate of potash, chromate of lead, or red lead; finally, if he indulged himself with a glass or so of grog before going to bed, he would incur the risk of having the coats of his stomach burned and irritated with tincture of capsicum, or essence of cayenne." If he gets nothing worse than cayenne in his grog, in this country, he is lucky indeed.

Foreign substances are mixed with food for two purposes, both of which have, almost solely, fraud as their object. The first aim is to increase the bulk and weight of the article sold. To effect this, some worthless or very inferior substance is used, without regard to any thing except its cheapness and the possibility of admixture without detection. Often, as in the case of the adulteration of coffee with chicory and other roots, or with various grains and leguminous seeds, this is sufficient for the pur-

poses of the operators; but more commonly the first fraud, by altering more or less the sensible qualities of the article, necessitates a second, namely, the employment of coloring, flavoring, and scenting substances. These may be used either to give a better appearance to articles which are of an inferior quality, or which have been damaged; or a greatly adulterated and even an almost entirely factitious article may be so colored and manipulated as to completely deceive the eyes and other senses of the purchaser. Cocoa, mustard, and spices, may be mentioned as liable to be thus, almost completely, *manufactured* articles.

The following table will show most of these articles classified as I have found them. Comparison with similar tables in Dr. Hassall's works, will show that while frauds in this country run nearly parallel with those in England, yet different substances are very often used here, doubtless because more available and cheaper. In the first column are the names of articles adulterated, in the others the adulterants under each head. It will be noticed that it is chiefly under the second head (substances added for coloring, scenting, etc.), that the most actively deleterious articles are to be found; thus adding another confirmation to the proverb, "*Il n'y a que le premier pas qui coûte;*" — having learned cheating, they find it but a short step from thence to poisoning.

	FOR BULK AND WEIGHT.	FOR COLOR, TASTE, ETC.
Arrow-root,	Cheaper arrow-roots and starches.	
Brandy (often entirely factitious),	Water; neutral spirits; whiskey; rum.	Burnt sugar; sugar; spirits of nitre; fusil oil; kino and other astringents; acetic acid.
Butter,	Water; lard; salt.	
Bread,	Corn-meal; potatoes; rye-meal.	Alum.
Bottled fruits,		Salts of copper.
Confectionary,	Starch; flour; plaster of Paris.	Cochineal, indigo; Prussian blue; ultramarine; carbonates of copper and lead; red lead, and the chromate of lead, or chrome yellow; gamboge; true and false Brunswick greens (either oxychloride of copper, or a mixture of chrome yellow with Prussian blue or indigo); emerald green or arsenite of copper; various ochres (umber, sienna, etc.); bronze powders.
Coffee,	Chicory; carrot; peas; beans; corn.	Burnt sugar.
Cocoa and chocolate,	Arrow-root; starch; sugar.	Red and brown ferruginous earths.
Cider (often entirely factitious),	Water.	Honey; sugar; tartaric acid; whiskey; alum; burnt sugar.
Cayenne,	Corn meal; salt.	Red lead; Venetian red.
Ginger,	Corn meal.	Turmeric.
Gin,	Water; sugar; neutral spirits.	Flavoring substances.
Honey (often entirely factitious),	Sugar; water; glucose.	
Lard,	Water.	Salt.
Mustard,	Wheat flour; corn flour; salt; cayenne.	Turmeric.
Milk,	Water.	Burnt sugar; salt; bi-carb. soda.

	FOR BULK AND WEIGHT.	FOR COLOR, TASTE, ETC.
Pickles,		Salts of copper.
Potted meats and fish,		Bole Armenian; Ven. red.
Rum,	Water.	Burnt sugar and flavoring substances.
Sugar (refined),	Wheat flour.	
Spices,	Flour; dirt; corn-meal; inferior or cheaper spices.	
Tea,	Lie tea; stalks; and leaves of other plants.	Black lead; gum; Prussian blue; gypsum; indigo.
Vinegar,	Water.	Burnt sugar; sulphuric acid.
Whiskey,	Water; neutral spirits.	Spts. nitre; fusil oil; burnt sugar; acetic acid.

The articles upon the analysis of which the above table is based, were chiefly purchased in the shops of this city (Boston); but there are the best reasons for believing that the same frauds are practised throughout the country, and in some places even to a greater extent than here.

Having thus briefly stated what it is my intention to demonstrate, and by what means, let us now proceed to a more detailed consideration of one of the chief articles on the list.

Wheaten bread is, in our favored country, an article of universal consumption; at least among the white population.* In the cities and large towns,

* The singular propensity which the negro race seem to have for fats, and which leads them to riot in fat bacon, and regard as a choice tit-bit the still fatter "'possum," appears to lead them

the greater portion of the bread which is consumed, is prepared by the bakers. Before commencing our examination of their work, however, it will no doubt be interesting to most of my readers, to learn a little of the rationale of the process of bread-making.

The composition of fine flour is quite simple. It contains about ten per cent. of a white, sticky substance, which is called, by the chemists, gluten. It is this which causes the particles of flour, when wetted, to cohere, and form the elastic mass called dough. If we place a portion of dough upon a sieve, and, under a stream of water, work it with the hand, the water will pass off milky, and, if the process be continued long enough, will leave the gluten nearly pure upon the sieve. The water, if received into a proper vessel and allowed to settle, will deposit starch in the proportion to the whole weight of the dry flour used, of about seventy per cent. These two substances, then, gluten and starch, constitute eighty per cent., or four fifths of the whole mass of the flour. Of the remaining twenty per cent. about fifteen or sixteen is water, and the remainder consists of a small portion of oil, and some other matters of minor importance.

To make flour into bread it is necessary to add to

also, instinctively, to prefer the corn cake to the white loaf, because of the greater per-centage of oil which exists in the grain of corn.

it about fifty per cent. of water; that is, one hundred pounds of good flour will make one hundred and fifty pounds of bread. But something else besides water is necessary to make the ordinary kinds of bread. This is something to cause the dough to "rise" — to make it spongy and light. For this purpose, in old times, yeast or leaven was used almost exclusively. These have the property of exciting fermentation in the dough, and one of the products of fermentation is carbonic acid gas, which, entangled in the mass of dough, and held there by the tenacious gluten, expands, and puffs it up. It is then formed into loaves and baked. When it is taken from the oven after baking, if it is cut across, it is found full of small holes which were formed by the bubbles of gas.

Now-a-days, since chemistry has interfered, for good and for evil, in most of the affairs of life; other, easier, cheaper, and quicker ways of raising bread have been devised, but all of them are based on the same essential principle, the production of carbonic acid within the mass of dough. This is commonly effected, in private kitchens, by the use of an acid, and an alkaline carbonate; the first being generally either tartaric acid, or one of its salts, the cream of tartar; and the alkali being the bi-carbonate of soda. The baking powders, sold in the shops, are merely mixtures already prepared of these

substances in their proper proportions, to which is usually added a quantity of starch, to increase the bulk, and also as a preservative.

It has always been urged as an objection to the use of these and similar substances, that the results of their union remain in the bread, in the form of a salt of soda or potash, which must prove injurious to the health of those who consume it. The greater frequency of urinary affections which has been noticed to exist of late, has, with some show of reason, been attributed to these salts, which are almost entirely eliminated from the system through the kidneys. Although it is perhaps impossible to produce positive proof that they are thus, or otherwise injurious, it may at least be regarded as highly probable. Many substitutes have been proposed; among others, one, in which phosphates are said to take the place of tartrates in the bread. It is claimed for this preparation, that it is not only harmless, but absolutely sanatory. The phosphates are generally held to be insoluble in the intestinal juices, and consequently inert; but if it be true that the product of the reaction between this "substitute" and an alkali is soluble, and may be absorbed, it appears rather to be an argument against, than in favor of its adaptability for the purpose proposed. While in some forms of disease, the administration of phosphatic medicines might be desirable, it would appear

preferable that they should be given in a manner more under the control of the physician who prescribes them; — in healthy individuals, the habitual use of any medicinal substance, however apparently harmless, is not a practice to be commended. Cream of tartar and tartaric acid are extensively adulterated — generally with starch or sulphate of lime, the adulteration often exceeding twenty per cent.

Theoretically, the best plan appears to be the one proposed by Liebig, wherein he substitutes the hydro-chloric or muriatic acid for the tartaric. His formula is as follows: —

Wheat flour	7 lbs.
Carb. soda	350 to 500 grains.
Water	2 3-4 pints.
Hydro-chloric acid . . .	420 to 560 grains.

The soda and flour are first intimately mingled, and then made into a dough, with the mixture of acid and water, which may be baked immediately. The results of the chemical reaction are simply chloride of sodium (common salt), and the carbonic acid gas required to lighten the dough. For bakers this is probably an available, as it is an excellent plan; but in families the use of a powerful corrosive acid in the hands of servants, and liable to fall into those of children, is a great and positive evil in the place of a lesser and somewhat hypothetical one. It seems on the whole, then, that the best of all

plans is to return to the old, though somewhat uncertain and troublesome, method of employing yeast, which certainly, when skilfully used, gives us a bread at which no one can justly cavil.

Wheat is an unlucky grain. If it escape the frost, the army-worm, the rust, the smut, the fly, and the weevil, and arrive at maturity unscathed, it may yet be spoiled in the field by unseasonable rains, which cause it to germinate. Sprouted or "grown" wheat, is a variety well known to the millers. It makes an inferior flour, inasmuch as the process of sprouting induces, in proportion to its progress, a change in the gluten of the grain, which measurably destroys its tenacity, — that property by which the carbonic acid gas is arrested and retained in the dough, giving lightness and sponginess to the bread.

Three processes are known, or rather three substances, which have the power of restoring to the gluten of grown wheat some of its original properties. These substances are sulphate of copper (blue vitriol), alum, and lime water; the latter suggested by Liebig. Of these, either because of its cheapness, its availability, or perhaps its more certain and uniform action, alum seems to have the preference with the bakers. From eight to sixteen ounces to each barrel of flour is the usual allowance. This is the result of a careful analysis of

bread bought in different parts of this city; not a loaf was found free from that stringent mineral, which cannot fail to disorder the stomach, producing dyspepsia, headache, constipation, and irritation of the bowels. These uniform results, from the tests applied to numerous samples, go strongly to contradict the assertion, made by several anonymous writers in the newspapers (who, evidently in the interest of the bakers and flour-dealers, attacked my statements upon this point, in the papers which I contributed to the columns of the *Boston Courier*), that a large, if not the major part of the best flour brought to market, is used by the bakers; unless, indeed, for the sake of whiteness alone, or for some unknown purpose, they mix alum not only with poor but with good flour.

Every one notices the difference in smell, taste, and color, between baker's and home-made bread. It is generally destitute, in a great degree, of the sweet nutritious taste and the agreeable smell which belong to pure bread. It is whiter and lighter — both due to the use of alum — but its taste is dry and insipid, and it is extremely apt, in delicate persons, to produce heart-burn, or acidity of the stomach. Now there is no reason whatever why the bread of the baker should differ from household bread, except in being superior to it; for the skill, experience, and uniformity of his processes ought to

secure a better result than is always practicable in the family kitchen. How woefully the other way the case is, is known to all. Yet in Paris, where these things are regulated by the vigilant arm of the law, aided by science, the baker's bread is eminently good; — light, sweet, and digestible; such as it must be when made of a proper quality of flour, which requires no drugging to make a good-looking bread.

Baker's bread has very frequently a large admixture of corn or rye meal, and, occasionally, potatoes. These are not objectionable additions, provided the purchaser is allowed to benefit by the reduction of cost; but this is rarely the case. In my analyses, I find as an almost universal rule, that the dearest bread as to weight, is also made of the poorest flour, and contains more alum and more meal. If the more honest bakers, who sell a nineteen ounce loaf of tolerably good bread for five cents, make a fair profit, as they undoubtedly do, what must be the gain of him who sells a fourteen ounce loaf, made of poorer flour, mixed with fifteen per cent. of meal, for the same money? And these are generally the class of bakers most patronized by the poor; who are least able to bear such imposition, and, having no facilities for baking, must depend entirely upon the baker for a supply. A difference of over thirty per cent. upon an article of prime necessity, like bread, is a serious tax upon a laboring man. It

may be said that he is not compelled to buy at such places; but it is enough for us to know that through ignorance or carelessness he does so, and that a proper enforcement of the laws already existing would afford him ample protection. It will not do for us, in this or any case where the poor and ignorant become the prey of knaves, to make to our consciences Cain's answer, "Am I my brother's keeper?"

The following is the law relating to the sale of bread in this State, and every citizen will see at a glance that none of its provisions are complied with or enforced.

SEC. 5. A loaf of bread for sale shall be two pounds in weight. Bread, except that composed in chief part of rye or maize, shall be sold in loaves, half, three-quarter, and quarter loaves, but not otherwise.

SEC. 6. In every shop or place where bread is sold by retail, and in each front window thereof, there shall be conspicuously placed a card, on which shall be legibly printed a list of the different kinds and qualities of loaves sold there, with the price of each by the loaf, half, three-quarter, and quarter loaf.

SEC. 7. Bread sold in any shop or place shall be weighed in presence of the buyer, and if found deficient in weight, bread shall be added to make up the legal weight.

SEC. 8. Whoever violates either of the provisions of the three preceding sections, shall forfeit ten dollars for each offence, to be recovered in an action of tort to the use of the party suing therefor.

Sec. 9. The four preceding sections shall not apply to rolls or fancy bread weighing less than one-quarter of a pound.

This law, if the police were instructed to enforce it, would be a complete protection against frauds in weight. The addition of a city ordinance, requiring that every loaf should be legibly stamped with its weight, might facilitate the operation of the law. This is done in the city of Edinburgh, and is found to work admirably, as is shown in the following letter to the editor of the London Lancet: —

Sir, — In your admirable exposures of the nefarious practices of bakers in their trade, I observe you do not limit your investigations to adulterations, but show up the equally dishonest system they follow of muleting the public in the understood weight of their bread. The act of Parliament professing to check this latter fraud, in practice is a dead letter, as it places the onus of checking the baker on the purchaser, and imposes a trouble which in ninety-nine cases out of a hundred the public will not take.

I write this to acquaint you with a plan which is in every way a most effectual check to dishonesty in the weight of bread: and as it has been enforced for about three years in this city by law, its practical efficiency for the purpose has been fully established.

The plan is simply to make it imperative on the bakers to stamp the weight upon all the loaves he makes. The provision to this effect in the police act of Edinburgh is twofold. It enacts, 1st. That every loaf of bread shall have impressed upon its upper surface the imperial weight in legible figures and letters; 2d. That the vendor of any loaf not so stamped, shall, if stamped with a

false or unjust denomination of weight, be liable to a penalty of, I think, £5, and if unstamped he shall be liable to a like penalty, and the forfeiture of the bread. Fancy bread is exempt from this law.

I am happy to say, as the originator of this provision, that it has worked most satisfactorily, both for the fair dealer and the public, since it came into operation in Edinburgh. While it makes the baker or vendor of bread responsible for the weight of his loaves, it imposes no extra trouble or other restriction on him in his business. It merely makes him do what every other tradesman does — that is, vend his commodity by weight and not by lump, as is virtually the way everywhere except in Edinburgh.

If these observations on a very important matter as regards the interests of the poor, who are the parties most imposed upon by the short-weight bakers, be thought worthy of publication in your patriotic pages, I shall be very glad.

I am, sir, your obedient servant,

James S. Torross.

The admixture of corn-meal with bread, is easily detected by the naked eye; the bright yellow grains of the meal may be seen more or less thickly scattered about in the loaf. To ascertain the presence of rye flour and potatoes, the aid of the microscope is required, when they may be recognized by the peculiarities of their starch granules, which, although somewhat modified in form by the process of conversion into bread, are yet distinguishable from those of wheat. For alum, unfortunately there is no positive test which is at the same time sufficiently simple and easy for general use. The fol-

lowing is the process of Dr. Hassall, which I have followed in my own analyses: —

"Incinerate 1,000 grains of the flour or bread; boil in a flask with 4 drachms of nitric acid, 4 of hydro-chloric acid, and 4 of water; evaporate to dryness. When cold, add one ounce of distilled water, and boil for a few minutes; while boiling dilute with one ounce liq. potassæ, and boil again for a few minutes; then filter, nearly neutralize with hydro-chloric acid, and precipitate with ammonia. The precipitated alumina should be washed, dried, ignited in a platinum dish, weighed, and calculated for alum."

A very good criterion with regard to baker's bread, is found, however, in its greater or less similarity, in taste, smell, and appearance, to a good home-made loaf. As I have previously remarked, all variations from this standard, are due to no other cause than the employment of inferior flour, and of the more or less deleterious substances employed to render it capable of being used to make bread which shall have somewhat the appearance, at least, of a wholesome article.

Of the injurious effect upon the human system, of food impregnated with alum, I have said but little, because that appears to me superfluous. The following extract from the standard work of Dr. Wood on "*Therapeutics and Pharmacology*," will, I

think, be regarded by most as conclusive upon the point.

"When swallowed in the quantity of a drachm or more, it (alum) not unfrequently causes nausea and vomiting, and sometimes produces griping pains and purging. Devergie found about six drachms of dried alum, given to a dog, to produce death when the œsophagus was tied, so as to prevent vomiting. Under such circumstances, the mucous membrane of the stomach and bowels has been observed to be much inflamed." "When used for a considerable time, in doses insufficient to nauseate, alum not unfrequently produces a sense of stricture in the epigastrium (pit of the stomach), precordial oppression (oppression about the heart), and other dyspeptic feelings, probably by interfering with the secretion of the gastric juice, and thus impairing digestion." — (Vol. I. pp. 135, 136.)

CHAPTER II.

TEA. — ITS INTRODUCTION INTO EUROPE AND AMERICA. — CULTIVATION AND PREPARATION. — ADULTERATIONS.

For a long time after it had become an article of daily use in Europe and in this country, knowledge regarding the particular origin of tea, its cultivation and manufacture, was limited almost entirely to the patent facts that it was the leaf of a plant, and that it was brought from that *terra incognita*, the Chinese empire.

Vague and contradictory tales of travellers, who gathered their information chiefly from the natives of the few ports with which Europeans were allowed to trade, were all we had. Even the few embassies, and those adventurous men who penetrated somewhat further into the interior, added not much to our stock of knowledge upon the subject. We were told, indeed, that it was the leaf of an evergreen shrub, or small tree; that it grew upon precipitous mountains, where even men could not approach, and the leaves had to be gathered by the more agile

monkey, who was trained for that purpose. Many, perhaps, will remember seeing in the old "Penny Magazine" (whose rude wood-cuts and simple text did so much, notwithstanding occasional errors, to popularize and diffuse knowledge), representations of unlikely *quadrumana*, under the direction of improbable Chinese, engaged in gathering the leaves of most incorrectly drawn tea-trees, on impossible cliffs. We were entertained further, with wonderful accounts regarding its culture and preparation. We had pictures of tea-plantations on the low land by the river side (where it will not grow), and caricatured Chinamen upon a treadmill, pumping up the water to irrigate a plant, as independent as the sun-loving cotton, of artificial moisture. Then we were told how, before the picking season began, every laborer went through a course of dieting and purification, that the exhalations of his body should not contaminate the tea, upon which he was not allowed even to breathe; how he must wear the cleanest clothes, with gloves upon his hands, and have three baths a day, at the least. The leaves were picked gingerly, one by one, and as separately manipulated and rolled; and, to add to the particularity, dried upon copper plates, to which fact was due, we were told, the color of green teas, while the black were dessicated upon the more humble iron. There were two distinct kinds of tree, too; from

one, which was called *Thea viridis*, only green teas were made; and equally would the other, *Thea Bohea*, produce only black.

We consider ourselves much the superiors of the yellow, oblique-eyed Mongols; and doubtless, in some things, justly; but it is easy to imagine a New York cotton broker, however skilled in the commercial points of "long-staple" and "short-staple," "sea-island" and "upland;" anxious to convince some inquisitive Briton of his extensive knowledge, and giving him imaginary accounts of the cultivation and preparation of our great staple, and of the condition of the race who cultivate it, as far and even further from the truth, than the stories travellers brought us about the tea.

When Robert Fortune, in his "*Wanderings in China*," first distinctly asserted that the difference between green and black teas lay solely in the different methods of preparation, his statements were assailed and denied; but further investigations by others, and by Mr. Fortune himself, during three years travel, a most interesting account of which is given in his "*Tea Countries of China*," has not only set that question at rest, but also shown the absurdities of the monkey story, and all the other marvels to which I have alluded; and we have now as complete and accurate knowledge regarding this most important plant, its growth, and the manufacture of

its product, as we have of any of the other great agricultural staples.

Tea is now probably consumed, as a common beverage, by five hundred millions, or one half of the human race; and perhaps nothing so well and so harmlessly supplies the universal craving for an artificial stimulant. It quickens the circulation, promotes digestion, and enlivens the intellect. All these are most agreeable and desirable effects, and it appears, as ordinarily used, to be incapable of inflicting any serious injury upon the system. Drank immoderately, or by those unaccustomed to its use, it causes sleeplessness and muscular tremors, and, in the case of professional tea-tasters and packers, it has occasionally been known to produce paralysis. Its active principle, which exists in a proportion of about two per cent., has been extracted by the chemists. It is styled *Theine*, and is identical with that of coffee, cocoa, and maté, or the Paraguay tea. It is a singular and instructive fact, pointing to a pressing need of the human system, that in such far-sundered countries as China, Arabia, and South America, man should have sought and found, in plants of widely different botanical families, a stimulant which chemical science has demonstrated to be precisely the same in all. Theine exists in the form of minute, colorless crystals, without smell, and possessing only a slightly bitter taste.

Consequently the flavor of tea depends but little upon this substance, and is due chiefly to the volatile oil, existing in the proportion of about one per cent., and the tannin, or vegetable astringent principle, which forms from thirteen to eighteen per cent. of the whole weight of the tea. The other chief constituents of the tea are not extracted to any extent by the ordinary process of infusion. The following analysis of a sample of tea, shows the chief constituents in a tabular form. Those marked with an asterisk (*), are very variable in different samples.

Essential oil	1
Theine	2
Tannin	16 *
Gluten	24
Woody fibre	19 *
Starch, gum, fat, etc.	28 *
Ash	5
Water	5
	100

The operation of theine upon the system has been ascertained by experiment. The quantity usually contained in half an ounce of good tea is about four or five grains. When taken in this quantity it is found to diminish the waste of the body, and thus to lessen the necessity for food. When eight or ten grains are taken daily, the pulse is rendered stronger and more frequent, and trembling ensues. The

imagination, in sensitive individuals, is excited, the thoughts wander, visions are seen, and a species of intoxication induced. These symptoms are succeeded and relieved by a deep sleep. These experiments show that the chief effects of tea upon the system are attributable, in great measure, to its theine. The flavoring principle, or essential oil, is perhaps likewise somewhat concerned in the stimulating effect; the tannin gives the astringency of taste, and has a slight constipating effect upon the bowels.

By our method of drinking tea, the insoluble matters, which contain considerable nutriment, are lost; but this loss is more than compensated by the milk and sugar which is usually added. In some countries, the tea leaves, either whole or in powder, are themselves eaten, and thus all of the beneficial properties of the tea are secured.

"The wealthy Chinese simply infuse the leaves in an elegant porcelain cup, which has a cover of the same material; the leaves sink to the bottom of the cup, and generally remain there without inconvenience, though occasionally some may float or rise to the surface. To prevent this inconvenience, sometimes a thin piece of silver, of filagree, or open work, is placed immediately on them. Where economy is necessary to be studied, the teapot is used. The wealthy Japanese continue the ancient

mode of grinding the leaves to powder, and after infusion in a cup 'it is whipped with a split bamboo, or denticulated instrument, till it creams, when they drink both the infusion and powder, as coffee is used in many parts of Asia.'" * While wandering over the tea districts of China, Mr. Fortune only once met with sugar and a teaspoon.

Tea has been used as a beverage in China from very remote periods. Tradition speaks of it as early as the third century. The legend relates, "that a pious hermit, who, in his watchings and prayers, had often been overtaken by sleep, so that his eyelids closed, in holy wrath against the weakness of the flesh, cut them off and threw them on the ground. But a god caused a tea-shrub to spring out of them, the leaves of which exhibit the form of an eyelid bordered with lashes, and possess the gift of hindering sleep." It was after the year 600 that the use of tea became general in China, and in 810 it was introduced into Japan. To Europe it was first brought by the Dutch East India Company; and it must have been in use in England by the year 1650, as appears from an act of Parliament passed in that year, in which a tax of one shilling and sixpence was laid on every gallon of tea sold at the coffee-houses. Pepys' Diary has the following entry,

* Bell on the Cultivation and Manufacture of Tea.

dated September 25, 1651: — "I did send for a cup of tea (a China drink), of which I never drank before." Six years after it had found its way into his own house; — "Home — found my wife making of tea, a drink which Mr. Pelling the potticary tells her is good for her cold," etc.

About this time the East India Company ordered "one hundred pounds weight of goode tey" to be sent home on speculation. The price was about fifty or sixty shillings a pound, and two pounds three ounces of the best tea was not deemed an unfitting present from the East India Company to the king. "Hot infusions of leaves had been already long familiar as drinks in European countries. Dried sage leaves were much in use in England,* and are even said to have been carried to China by the Dutch, to be there exchanged for the Chinese leaf, which has since almost entirely superseded them. A Russian embassy to China also brought back to Moscow some carefully packed green tea, which was received with great acceptance." † — (JOHNSTON.)

The introduction of tea into this country, fol-

* Sage was in frequent use till after the middle of the last century. In the Life of Whitfield, it is stated, that, when in his fasting humors at Oxford, "he ate nothing but sage tea without sugar, and coarse bread." This was about 1739.

† *The Plant*, by SCHLEIDEN. 2d ed. p. 142.

lowed soon after it became known in England, but out of the large towns its use was not general, among people in moderate circumstances, until after the revolutionary war; when a direct trade sprang up between this country and China, and tea was largely imported. During the revolution, in consequence of the previous refusal in all the ports to permit tea to be landed, it became very scarce; and many of the wealthier ladies of the cities, whose hearts perhaps were more patriotic than their stomachs, carried their small canisters of tea about with them when travelling in the interior, where it was not likely to be found.

The tea-plant belongs to a genera of plants very closely allied to the *camellia*. Indeed, among the Chinese, they bear the same name, and the botanical distinction between the two consists chiefly in the seed. The seed vessel of the tea is a three-lobed capsule, with the lobes strongly marked, and each of them the size of a black currant, containing one round seed. The capsule of the camellia is not lobular externally, but contains altogether three seeds like that of the tea, though of a longer shape. — (Davis.)

The shrub is an evergreen, growing, when wild, to a height of from six to eight feet. The blossoms, which open early in the spring, are white, numerous, and about the size of those of the plum, which they resemble.

Tea grows spontaneously in China, Japan, and in the hills of Upper Assam, adjoining the Chinese frontier. It is cultivated not only in these countries, but also extensively in the hill country of India. Mr. Fortune's journey, of which we have an account in his "*Tea Countries*," was undertaken and successfully carried out, for the purpose of procuring an abundant supply of the best plants, and a number of the most skilful hands to prepare the tea. All this was undertaken at the instance and in the service of the East India Company, and India now produces a considerable quantity of tea, much of it of an excellent quality. The tea produced in the island of Java supplies, to a considerable extent, the markets of Holland, and Brazil produces a portion of the quantity consumed in that empire. Efforts have been made to introduce the cultivation of the tea plant into the United States. Some plants were brought to Georgia in the latter part of the last century, but they seem not to have succeeded. From 1848 to 1852, the late Dr. Junius Smith of South Carolina, spent a good deal of time and money in experiments, and seems to have succeeded in demonstrating that many parts of the Southern States are well adapted to the growth of tea. While it is not probable that, with the expensive labor of this country, we could compete successfully with China in the production of tea, yet if propagated by

our nurserymen to an extent sufficient to allow of a not too difficult and expensive supply of the plants, many families in the South, and in the Middle States, might be able to raise sufficient for their own use.

Notwithstanding the partial success of tea culture in other countries, China with tea, as this country with cotton, will probably long maintain the practical monopoly of the markets of the world. Its growth and consumption are now enormous. The total produce of the dried leaf in China has been estimated by good authority at 2,240,000,000 of pounds, and the extent of land devoted to its culture in that country, to over three millions of acres.

The finest tea of China is grown between the twenty-seventh and thirty-first parallels of north latitude. The best green teas of commerce are from the province of Fuhkien, and from Huichau, in the province of Kwangtung (Canton); the best black from the Moning districts, near the Poyang lake. The former are south and the latter north of the range of the famous Bohea hills, from which the black teas originally had their name. The produce of the different districts varies much in quality and flavor with the soil, the climate, the season, and the variety of the plant cultivated; as well as with the period at which the leaves are gathered, and the mode of drying them.

The principal varieties of black tea are Bohea, the cheapest and commonest; Congou, Souchong, Caper, and Padre Souchong, and Pekoe. The latter is the finest, consisting of the very young and unexpanded leaves. When covered with down, this is called flowery Pekoe. The chief varieties of green tea are Twankay, Hyson-skin, Young Hyson, Hyson, Imperial, and Gunpowder. Imperial, hyson, and young hyson, consist of the second and third gatherings; while the light and inferior leaves, separated from hyson by a winnowing machine, constitute hyson-skin. The true imperial, known also as the "flottheae," is seldom exported,—that usually sold as imperial being a fine variety of green tea, scented with the blossoms of the sweet-scented olive (*Olea fragrans*). The practice of scenting teas is very common, and various odoriferous plants are employed for the purpose in different parts of China.* It is remarked however by the dealers in tea, that the plantations which naturally yield a

* Among these are mentioned the Olea fragrans, Chloranthus inconspicuus, Gardenia florida, Aglaia odorata, Mogorium sambac, Vitex spicata, Camellia sasanqua, Camellia odorifera, Illicium anisatum, Magnolia yulan, Rosa indica odoratissima, Murraya exotica, turmeric, oil of Bixa orellana, and the root of the Florentine Iris. With such a list before us, we cannot wonder that teas should exhibit great diversity in fragrance and flavor. — (JOHNSTON.)

produce of a particularly-esteemed flavor are as limited in extent as the vineyards in Europe which are celebrated for particular kinds of wine. The price of tea varies, of course, with the variations in natural quality, being for some samples, double or treble what is asked for others. The average price at Canton is about sixteen cents a pound.—(Meyen.)

The tea-plant is usually propagated from seed, which is kept over winter in moist earth to secure germination, and sown in March. When a year old, they are set out in plantations, in rows three or four feet apart. Their branches are repeatedly nipped, or "pinched in," as the gardeners phrase it, to make them grow thick and bushy, and the cropping of the leaves is begun when they are four or five years old.

Most of the plantations in the northern tea-districts (says Mr. Fortune) are situated upon the sides of the most fertile hills. Further south, in many places, the plant is grown upon the level lands, but these plains are at a very considerable elevation above the sea. Teas grown in these different localities are known in commerce respectively, as "hill-tea" and "garden-tea." The plant requires a rich but light and well-drained soil, and refuses to thrive in moist lands.

The plantations are generally small, and the

shrubs, which are not allowed to grow higher than three or four feet, present the appearance of little shrubberies of evergreens. Mr. Fortune gives a very pleasing account, in his *Wanderings*, of the happy condition, and simple manner of life of the Chinese peasantry who are engaged in the cultivation of tea. "I really believe," he says, "that there is no country in the world where the agricultural population are better off than they are in the north of China. Labor with them is a pleasure, for its fruits are eaten by themselves, and the rod of the oppressor is unfelt and unknown."

The continual cropping of the leaves is very injurious to the tea-shrubs, and after ten or twelve years they become so unproductive that it is necessary to dig them up and plant out new ones.

The season for gathering varies in different districts. In the green tea districts of Chekiang near Ning-po, the first picking, which consists of the young, half-expanded leaf-buds, is made about the middle of April. This forms a very fine and delicate kind of young hyson, the picking of which is very injurious to the trees; consequently but a small quantity is made, generally for presents to friends. The principal leaf-harvest occurs in May or June.

Contrary to what was formerly believed, no very particular care is exercised in picking the leaves,

which are hastily stripped off from the branches, often removing at the same time, portions of the more tender shoots and the half-grown berries, which may often be picked out from the tea which we purchase. More care is exercised in picking the leaf for the finer kinds, but even then the process is very rapidly performed. This part of the work is chiefly done by women. The youngest leaves give the best and highest flavored tea. The second and third gatherings are more bitter and woody, and are inferior in every way to the first. The refuse and decayed leaves, often with the admixture of the serum of sheep or ox blood, to make them cohere, are pressed in moulds, and in this form are sold to the poorer classes in northern China and Thibet, under the name of brick tea.

The method of preparing the tea for market is quite simple and interesting. The world is indebted to Mr. Fortune, almost entirely, for the accurate knowledge now possessed upon this point. His clear and practical descriptions of what he saw, are all that could be desired, and are a model to other travellers, most deserving of imitation.

The leaves, when fresh, possess nothing of the taste or odor of the dried tea. This is entirely developed by the chemical changes through which the leaves pass during the process of manufacture; and these changes also, modified by the variations of

manipulation, decide whether the result of the operations, when completed, shall be a black or a green tea.

The following is an abstract of Mr. Fortune's description: —

For Green Tea. — When the leaves are brought in from the plantations, they are spread out thinly on flat bamboo trays, in order to dry off any superfluous moisture. They remain for a very short time exposed in this manner, generally from one to two hours: this, however, depends much upon the state of the weather.

In the mean time the roasting-pans — made of sheet iron, and set in brick-work over a fire — have been heated. A portion of leaves is now thrown into each pan, and rapidly moved about and shaken up with both hands. They are immediately affected by the heat, which is regulated entirely by the sensations of the operator, and is usually about as great as he can comfortably bear in handling the leaves. They begin to make a crackling noise, and become quite moist and flaccid, while at the same time they give out a considerable portion of vapor. They remain in this state for four or five minutes, and are then drawn quickly out and placed upon the rolling-table and rolled with the hands. During this process, a great portion of the sap is expressed by the pressure of the hands, and runs through the table, the top of which is made of strips of bamboo or ratan.

Being again thrown into the pan, a slow and steady charcoal fire is kept up, and the leaves are rapidly moved about by the hands of the workmen. Sometimes they are thrown upon the table, and rolled a second time. During this second roasting the leaves shrivel and twist up, assuming the form in which they come to us. In about an hour, or an hour and a half, the leaves are

well dried, and their color has become *fixed*, that is, this is no longer any danger of their becoming black. They are of a dullish green color, but become brighter afterwards.

The most particular part of the operation has now been finished, and the tea may be put aside until a larger quantity has been made. The second part of the process consists in winnowing and passing the tea through sieves of different sizes, in order to get rid of the dust, twigs, and other impurities, and to divide the tea into the different kinds known as twankay, hyson-skin, hyson, young hyson, gunpowder, etc. During this process it is re-fired — the coarse kinds once, and the finer sorts three or four times. By this time the color has come out more fully, and the leaves of the finer kinds are of a dull bluish green.

For Black Tea. — When the leaves are brought in from the plantations, they are spread out upon large bamboo mats or trays, *and are allowed to lie in this state for a considerable time*. If they are brought in at night, they lie until next morning.

The leaves are next gathered up by the workmen with both hands, thrown lightly into the air, and repeatedly tossed about in this manner, being slightly beat and patted with the hands at intervals, for a considerable time. At length, when they have become soft and flaccid, they are thrown in heaps, and *allowed to lie in this state for about an hour, or perhaps a little longer*. When examined, at the end of this time, they appear to have undergone a slight change in color, are soft and moist, and emit a fragrant smell.

The rolling process now commences. Several men take their stations at the rolling table, and divide the leaves among them. Each takes as many as he can press with his hands, and makes them up in the form of a ball. This is rolled upon the table and greatly compressed, the object being to get rid of a portion of the sap and moisture, and at the same time to twist the leaves. These balls of leaves are frequently shaken out, and passed from hand

to hand until they reach the head workman, who examines them carefully to see if they have taken the requisite twist. When he is satisfied of this, the leaves are removed from the rolling-table and shaken out upon flat trays, until the remaining portions have undergone the same process. In no case are they allowed to lie long in this state, and sometimes they are taken at once to the roasting-pan.

The next part of the process is exactly the same as in the manipulation of green tea. The leaves are thrown into an iron pan, where they are roasted for about five minutes, and then rolled upon the table.

After being rolled, the leaves are shaken out, thinly, on sieves, and exposed to the air out of doors. A framework, for this purpose, made of bamboo, is generally seen in front of all the cottages among the tea hills. The leaves are allowed to remain in this condition for about three hours: during this time the workmen are employed in going over the sieves in rotation, turning the leaves and separating them from each other. A dry but not sunny day is preferred for this part of the operation.

The leaves having now lost a portion of their moisture, and having become considerably reduced in size, are removed into the factory. They are roasted again for three or four minutes, and then again rolled as before.

The charcoal fires are now got ready. A tubular basket, narrow at the middle and wide at both ends, is placed over the fire. A sieve is dropped into the tube, and covered with leaves, which are shaken on it to about an inch in thickness. After five or six minutes, during which time they are carefully watched, they are removed from the fire and rolled a third time. As the balls of leaves come from the hands of the rollers, they are placed in a heap until the whole have been rolled. They are again shaken on the sieves as before, and set over the fire for a little

while longer. Sometimes the heating and rolling are repeated a fourth time; the leaves have now assumed a dark color.

When the whole have been gone over in this manner, they are placed thickly in the baskets, which are again set over the charcoal fire. The workman now makes a hole with his hand through the centre of the leaves, to allow vent to any smoke or vapor which may rise from the charcoal, as well as to let up the heat, which has been greatly reduced by covering up the fires. The tea now remains over the slow charcoal fire, covered with a flat basket, until it is perfectly dry, — carefully watched, however, by the manufacturer, who every now and then stirs it up with his hands so that the whole may be equally heated. The black color is now fairly brought out, but afterwards improves in appearance. The after processes, such as sifting, picking, and re-firing, are carried on at the convenience of the workmen. The effect of all these proceedings, is to reduce the weight of the leaves, so much, that three pounds of green leaves produce but one pound of tea.

This above description shows how, by a mere difference in the methods employed, both black and green teas are made. The leaves for green teas are roasted as soon as possible after they are gathered, and dried off immediately after the rolling process. This preserves their green color. On the other hand, the leaves for black teas are allowed to lie some time after gathering; they are then tossed about and exposed to the air; the roasting and rolling processes are delayed and interrupted, and the tea again allowed to lie for some time in the open air previous to the final firing, which is very slowly conducted. It has been observed by Mr. Warring-

ton, of Apothecaries' Hall, London, that the leaves of almost all plants when treated in a like manner, present similar phenomena; those which are dried quickly, and as soon as possible after being plucked, retaining their color in a great degree; while those which are allowed to lie for some time, and are then dried slowly, appear to undergo a species of fermentation which causes them to assume a color more or less dark.

The teas after being thus prepared, are sold to the dealers, and by them assorted into "chops" of different qualities, re-fired, and then packed for exportation.

Having now traced briefly the process of cultivation and manufacture, which are necessary before the tea is brought into market, it remains to give a description of the different adulterations to which it is subjected.

In England, considerable quantities of spurious tea are manufactured from the leaves of the sloe, hawthorn, elder, and other plants; and, in addition, the exhausted leaves are collected from the hotels and restaurants, re-dried, colored, and mixed with genuine teas. I have not been able to learn that any of these practices are carried on in this country. All of the frauds which I have been able to detect, had their origin in China, and the ingenious rascality of the people of that country appears to be so

great as to preclude the competition of even Yankee ingenuity.

The adulterations of tea by the Chinese consist, first, in the intermixture in genuine tea of the leaves of other plants, as the ash, plum, camellia, etc.; secondly, in the manufacture of a spurious article denominated *Lie-tea;* and, thirdly, in glazing, painting, or artificially coloring the surfaces of the leaves with various pigmentary substances.

The adulteration of tea with the leaves and twigs of other plants, seems, so far as my observations have extended, to be confined to the lower grades of black tea. In them I have repeatedly detected leaves which were evidently entirely unlike those of the tea-plant; some of them I have been able to identify definitely as the leaves of particular plants; while others, though differing from tea-leaves, yet were not recognizable, as belonging to any species of which I possessed a description. The genuine leaves are lanceolate, finely serrated, and usually from one to two inches long. In those of medium and large sizes, the venation is well-marked and peculiar, a series of characteristic loops being formed along each margin of the leaf. In none of the leaves, even those of the nearly allied camellia, which are used to adulterate tea, is this peculiar venation seen. It consequently forms a most valuable guide in the detection of this fraud.

As an evidence of the ease with which factitious teas may be fabricated, Mr. Fortune gives an account of the preparation of a variety of leaves at Calcutta, by Chinamen, to show the process of making tea, and says that when the operations were completed, the samples were so like the teas of commerce, that nineteen persons out of twenty would never have suspected them to be any thing else. "Here, then," he says, "were very fair looking green teas made from the leaves of a large tree, as unlike the tea-shrub as could well be. And an article as closely resembling black tea could have been just as easily made out of these leaves."

The only other vitiation to which black tea appears to be subject, is the coloring of some of the inferior kinds, probably made up in part of exhausted leaves, with black lead (graphite), which is made to adhere by means of gum-water. It gives the leaves a peculiar, black, and glossy appearance. I have detected this only in one sample, but that is sufficient to show that such tea is sold in this country, and to caution purchasers to be on the look-out for it. The substance used is perhaps better known as "stove-polish," and will hardly be regarded as a desirable addition to our morning beverage.

The detection of this adulteration is not difficult, when attention is once drawn to it. The deep black, with the glossy appearance given by the gum, is characteristic.

Lie-tea is the honest name of a most dishonest article, manufactured with great ingenuity by the Chinese, and imported into this country in considerable quantities, to be used in the adulteration of genuine teas. It consists of the dust of tea and other leaves, mixed with sand or earth, and made up, by means of starch or gum, into little masses, which are afterwards painted or colored. It is expressly manufactured for adulteration, and used for that purpose by the Chinese, but quantities of it are brought into this country unmixed. Of this fact I am personally cognizant, having been shown, a few years since, in the warehouse of an extensive tea-importing firm in New York, large quantities of Lie-tea, put up in small chests and sold at fifteen or sixteen cents per pound to the retailers, and by them used for adulterating and depreciating genuine teas.

Mr. Warrington, in a communication read before the Chemical Society of London, May, 1851, and quoted by Dr. Hassall, in his work on "Adulterations Detected," says: —

On inquiry I have learned that about 750,000 lbs. weight of these teas have been imported into this country within the last eighteen months. Their introduction has been quite of modern origin; and I understand that attempts have been made to get them passed through the customs as *manufactured goods*, and not as teas; a title which they certainly richly merit. The Chinese, it appears, would not sell them, except as teas, and have the can-

dor to specify them as *Lie* teas; and if they are mixed with other teas of low quality, the Chinese merchant gives a certificate, stating the proportion of the *Lie-tea* present with the genuine leaf. The brokers have adopted the curious terms *gum and dust*, as applied to these Lie-teas and their mixtures, a cognomen which at first I had some difficulty in understanding, from the rapid manner in which the first two words were run together.

In the English market both black and green Lie-teas are sold, but, so far, I have only detected this vile adulteration in green tea. When once attention is drawn to the matter, detection is easy; the tea should be examined, and any suspicious masses picked out; if, when moistened, they crumble and break up, you have a specimen of Lie-tea before you. Burning the suspected sample to ashes is also an excellent test; the ashes of genuine tea never exceed five per cent. of the whole weight, while that of Lie-tea is often as much as fifty per cent.

I have already spoken of the chief article used in the coloration of black tea, but the artistic talent of the Chinese in this regard, is chiefly manifested in the green teas. For several years, since public attention has been called to the subject, a considerable proportion of the teas imported have been uncolored. This has been the result of a change in public sentiment upon the point, consequent chiefly upon the publication of these pernicious frauds by Dr. Hassall and others. Still, large quantities of colored teas are

yet imported, and will continue to be, until everybody is made fully aware that there is really no such thing as genuine *green* tea, the nearest approach to it being a yellowish olive green, verging to a slate color. The Chinese never use the bright green teas, — they make them for the outside barbarians, wondering, no doubt, what they find to enjoy in a drink composed of a decoction of tea, Prussian blue, turmeric, indigo, and gypsum.

"Young hyson," states Mr. Davis (Davis's Chinese, Vol. II. p. 464), "until spoiled by the large demand of the Americans, was a delicate, genuine leaf, and as it could not be fairly produced in any large quantities, the call for it on the part of the Americans was answered by cutting up and sifting *other* green teas through sieves of a certain size, and as the Company's inspectors detected the imposture, it formed no portion of their London importation. But the abuse became still worse of late, for the coarsest *black* tea-leaves have been cut up, and then colored with a preparation resembling the hue of green teas." "But this was nothing in comparison with the effrontery which the Chinese displayed in carrying on an extensive manufacture of *green teas* from *damaged black leaves*, at a village or suburb called Hon'in." "Certain rumors being afloat concerning the manufacture of green tea from old black leaves, the writer of this became curious to ascer-

tain the truth, and with some difficulty persuaded a Hong merchant to conduct him, accompanied by one of the inspectors, to the place where the operations were carried on. Entering one of these laboratories of fictitious hyson, the parties were witness to a strange scene. The damaged black tea leaves, after being dried, were transferred to a cast-iron pan, placed over a furnace, and stirred rapidly with the hand, a small quantity of turmeric, in powder, having been previously introduced. This gives the leaves a yellowish or orange tinge, but they were still to be made green. For this purpose some lumps of fine blue were produced, together with a substance in powder, which, from the names given to them by workmen, as well as their appearance, were known at once to be *Prussian blue* and gypsum." These were stirred into the tea in the pan, over the fire, until it had taken the fine bloom color of hyson. To avoid all possibility of error, regarding the substances employed, samples were taken. Mr. Bruce (Report on the Manufacture of Tea) states, that "in the last operation of coloring the green teas, a mixture of sulphate of lime and indigo, very finely pulverized, and sifted through fine muslin, in the proportion of three of the former to one of the latter, is added; to a pan of tea containing seven pounds, about half a teaspoonful of this mixture is put." "The indigo gives it the color,

and the sulphate of lime fixes it," and the consumer too!

Mr. Fortune, during each of his journeys, saw the process of coloring teas. He states that at one of its stages the hands of the workmen are quite blue. "I could not help thinking," he remarks, "if any green tea drinkers had been present during the operation, their tastes would have been corrected and improved."

Again, he says: "I have stated that the plants grown in the district of Che-Kiang produce green teas, but it must not be supposed that they are the green teas which are exported to England. The leaf has a much more natural color, and has little or none of what we call the 'beautiful bloom' upon it, which is so much admired in Europe and America. There is no doubt that all these 'blooming' green teas, which are manufactured at Canton, are dyed with Prussian blue and gypsum, to suit the taste of the 'foreign barbarians.'" He adds: "In every hundred pounds of colored green tea the consumer actually drinks more than half a pound of Prussian blue and gypsum. And yet tell the drinkers of this colored tea that the Chinese eat cats, dogs, and rats, and they will hold up their hands in amazement, and pity the poor Celestials."

In another place he narrates the following conversation: "One day an English gentleman in Shang-

hae, being in conversation with some Chinese from the green-tea country, asked them what reasons they had for dyeing the tea, and whether it would not be better without undergoing this process. They acknowledged that tea was much better when prepared without having any such ingredients mixed with it, and that they never drank dyed teas themselves; but remarked that as foreigners seemed to prefer having a mixture of Prussian blue and gypsum with their tea, to make it look uniform and pretty, and as these ingredients were cheap enough, the Chinese had no objection to supply them, especially as such teas always fetched a higher price."

Mr. Warrington, whom I have quoted before, in a paper read before the Chemical Society, says: — "Mr. Fortune has forwarded from the north of China for the Industrial Exhibition, specimens of these materials (tea dyes), which, from their appearance, there can be no hesitation in stating are fibrous gypsum (calcined), turmeric root, and Prussian blue, the latter of a bright pale tint, most likely from admixture with alumina or porcelain clay."

These pigmentary adulterations are easily recognized, and when a genuine green tea has once been seen, no one need be deceived by a colored sample, which, of necessity, carries conviction on its face.

How much of the injury sometimes known to result from the use of green tea, is attributable to

these drugs, is worthy of serious consideration. There is no reason why green tea should prove injurious, aside from adulteration, except from its greater strength. The active elements of both varieties, so far as chemistry is able to demonstrate, are the same, in not greatly varying proportions; and in all probability green tea, if pure, will prove as harmless as black, when used with moderation. The tests I have given are amply sufficient guides in selecting a genuine article, if due attention is given to the examination of the samples before purchasing.

CHAPTER III.

COFFEE — ITS HISTORY, CULTIVATION, PROPERTIES, ADULTERATIONS. — COCOA, AND ITS ADULTERATIONS.

Coffee, so frequently called the Arabian berry, and bearing as its botanical title the name of *Coffea Arabica*, is affirmed by the latest authorities not to be indigenous in any part of that country. By them its original habitat is stated to be in Southern Abyssinia, where it grows abundantly in a wild state over the rocky hills, and it has been traced as far as the sources of the White Nile. The name of Coffee is said to be derived from the Abyssinian province of Kaffa, and in that country its use as a beverage has existed from time immemorial. When we consider this, and the immediate proximity of the two countries, separated only by the narrow strait of Bab-el-Mandeb at the southern extremity of the Red Sea, it is difficult to believe that the plant is not only unknown, as a native, in the Arabian province of Yemen, which now yields us the delicious coffee of Mocha, but that its introduction there dates so recently as the fifteenth century. What

adds still more to the apparent improbability of this statement, is the fact that the same authorities admit that in Persia it was known and used as early as the year 875. Now Arabia lies exactly between Abyssinia and Persia, separating them completely, and giving no access from one to the other except across the Arabian peninsula, or by a long and dangerous navigation along its southern coast. And yet we are told that the Arabians received the coffee plant, not from the Abyssinian hills, almost in sight from their city of Mocha, but actually from Persia, and that not until its use had been known in the latter country for upwards of seven hundred years.

The story, which may be taken for what it is worth, is given on the authority of a manuscript which we are told is now deposited in the *Bibliothèque Nationale* at Paris. Coffee is there said to have been introduced into Arabia about the middle of the fifteenth century, by Megaleddin, Mufti of Ada, who met with it during a journey in Persia. From Ada the use of coffee rapidly extended to Mecca, Medina, and other Arabian towns, and in a short time public coffee-houses were everywhere established. At Grand Cairo, where it was speedily introduced, the use of it was prohibited in 1511, on the supposition that it produced intoxication and excited improper feelings. This prohibition, however, was

soon removed; but in 1523, when a second attempt was made to prohibit its use, a violent commotion took place in the city, and coffee was ever afterwards drunk with impunity. We see here another illustration of the futility of any attempt to prohibit the use to mankind of those substances for which, as for tea, coffee, spirituous drinks, and tobacco, there exists in their very nature an inextinguishable craving. Much may be done by moderate legal regulations, by moral persuasion, and by the diffusion of correct information regarding them, to prevent the evils which their excessive use gives rise to; but an attempt at any thing more evinces a zeal without knowledge, that, in its rash attempts to do good, produces often incalculable mischief. The present state of the temperance reform forcibly illustrates these remarks.

Coffee met with similar opposition in Constantinople. Coal being one of the substances prohibited by Mohammed as unfit for human food, the dervises pretended that roasted coffee must be included in this prohibition, and with the aid of the Mufti, who held the same opinion, all the coffee-houses were shut up. Upon the accession of a more liberal Mufti, the coffee-houses were again opened.

The use of coffee as a beverage, in the west of Europe appears to have been known about the end

of the sixteenth century. Prosper Alpin describes the plant in his works *De Plantis Ægypti* and *De Medicina Ægyptiorum*, 1591 and 1592. Burton mentions it in his "Anatomy of Melancholy," which is believed to be the first allusion made to it in an English book. He says: "The Turks have a drink called coffee (for they use no wine), so named of a berry as black as soot and as bitter, which they sip up as warm as they can suffer, because they find by experience that that kind of drink so used helpeth digestion and procureth alacrity." It was introduced into Marseilles, in 1644, by some gentlemen who accompanied M. De la Haye to Constantinople. Several bales were brought from Egypt to Marseilles in 1660, and in 1671 a coffee-house was opened in that city. Thevenot had already brought a small quantity of it to Paris, in 1657; but it was not generally introduced into that metropolis till 1669 by the ambassador from the Porte; and in 1672 a public coffee-house was opened by one Pascal, an Armenian, who afterwards went to London.

In France its introduction was resisted, and among others by the celebrated Mad. de Sévigné, who declared that the popularity of coffee would be merely ephemeral; and predicted, in her enthusiasm for Corneille that *Le Racine passerait comme le café* (Racine will be forgotten as soon as coffee);

both of which predictions indicate that the lady possessed but little of the true prophetic *afflatus*.

About the same time that we hear of it in France, coffee was introduced into England. So early as 1652, Danial Edwards, a Turkish merchant, brought with him a Greek servant, who understood the method of preparing it, and first sold it publicly. In 1660 a duty of fourpence a gallon was imposed, and in 1663 all coffee-houses were required to take out a license.

Cromwell, in the interest of the publicans, who found their business interfered with by the increasing sale of coffee, is said to have attempted the suppression of coffee-houses in London, and many sermons are extant, written about this time, in which the harmless and delightful beverage is covered with all the opprobrious epithets known in the rich vocabulary of clerical wrath.

Van Hoorn, governor of Batavia, under instructions from the Dutch East India Company, first procured the coffee plant from Mocha, and introduced it into that colony in 1690. From here, plants were sent to Amsterdam, and from thence, in 1714 a fine specimen was presented to Louis XIV., which is said to have been the parent of all that have since been cultivated in the Dutch and French West Indies. Stavorinus makes the date of the introduction of coffee into Java much more recent

than that given above on the authority of Boerhaave, in his "Index to the Leyden Garden," and states, incorrectly, that it was not brought to Batavia until 1722 or 1723.

In 1720 Jussieu sent from the Royal Botanical Gardens of France to the West Indies, by Captain Declieux, three coffee shrubs, two of which, in the long voyage, and from scarcity of water, perished, but the gallant captain, sharing his own scanty allowance with the *cafier*, succeeded in bringing it safe to Martinique, when it became the ancestor, it is said, of all the coffee plantations in America. In 1718 the plant had been introduced into the Isle of Bourbon and into Cayenne, and in 1732 it was cultivated in Jamaica. In 1784 the Spaniards began the cultivation of coffee in America, near Caraccas. During the wars at the beginning of this century, which destroyed the Spanish commerce, the cultivation of cocoa, which is kept with difficulty, was greatly curtailed, and coffee took its place; and now, although the cultivation of cocoa has been recently resumed to a considerable extent, coffee yet forms the staple of export in Costa Rica, and is largely grown throughout Central America. But the chief source of our supply in this country is from Brazil, where its cultivation has sprung up entirely within the present century, and extended rapidly, until it has assumed a place as the chief

among the exports of the empire. Scarcely more than fifty years have elapsed since the first cargo of coffee was shipped from Rio de Janeiro, and now Brazil supplies two thirds of the coffee of the world. The revolution in Hayti was the commencement of a new era for the coffee of Brazil. (God grant that the machinations of pseudo-philanthropy may not likewise result in a transfer to her from our country of the control of the cotton-trade).

Villaso, a Franciscan friar, in 1754, planted the first coffee-tree in the garden of the San Antonio convent at Rio. The cultivation of the plant spread slowly, however, and not until after the Haytien massacres did it attain commercial importance. In 1809 the first cargo was shipped to the United States. In that year the total product of coffee in the whole empire was but about 30,000 sacks, while in 1855 Brazil exported 3,256,089 sacks, the value of which was nearly $25,000,000. The whole sum paid by the United States in that year for coffee, was $21,514,196, of which Brazil received no less than $16,091,714.*

Dr. Livingstone, the African traveller, mentions

* For these facts and figures, and for much other information in regard to the cultivation and preparation of coffee in Brazil, which I have incorporated in these pages, I am indebted to the "Brazil and the Brazilians" of the Rev. Messrs. Kidder and Fletcher.

that the coffee-tree was taken by the Jesuit missionaries (how much the world owes to these indefatigable and well-abused fathers) to the western coast of Africa, where it has since become naturalized, and covers vast spaces of waste land. If the African negro can be civilized, perhaps the western coast of that continent may one day furnish to commerce a supply of coffee as good as, and more abundant than, the eastern.

The coffee-plant is a tree, which like the tea, thrives only in warm, rich, light, and well-drained soils. It attains, in general, a height of from eight to twelve feet, but sometimes even thirty feet. It has a gray-colored bark, and a dark, smooth, and shining evergreen foliage. It bears a profusion of delicate, white flowers, growing in thick clusters around the branches. When cultivated, it is propagated either by seeds or slips. They are started in nurseries, and afterwards transplanted into the fields, taking care to preserve the ball of earth about the roots, which are easily injured by exposure. In the plantations they are set six or eight feet apart, and begin to bear, usually, in two years. When in full bearing, they produce from 2,500 to 6,400 pounds of coffee from one thousand trees; the last named is regarded as an extraordinary yield. The trees are not allowed to exceed twelve feet in height, and are renewed about every fifteenth year. The berry,

when ripe, is sweet and quite palatable; it resembles a cherry or large cranberry in size and color; each contains two grains attached to each other by the flat sides; of these a negro can gather about thirty-two pounds in a day, and is considered capable of attending one thousand trees. There are three gatherings in a year, the first beginning in April, as the fruit does not ripen all at once. The blossoms are extremely beautiful and fragrant, but perish quickly, remaining on the trees hardly more than twenty-four hours. The berries, after being dried in the sun, are hulled and cleaned by machinery and placed in sacks for transportation and shipment.

The seeds of Arabian or Mocha coffee are small, and of a dark yellow color, those of Java and the East Indies, are larger, and of a paler yellow; while those of Ceylon, West Indian, and Brazilian coffee, possess a bluish or greenish-grey tint.

The fact has been recently made generally known, that the leaves of the coffee-tree resemble to a certain extent the seeds in their composition, and possess many of their properties. According to Mr. Ward, who has resided many years in Sumatra, a beverage made from roasted coffee leaves has long been in use. He says: "As a beverage the natives universally prefer the leaf to the berry, giving, as a reason, that it contains more of the bitter principle,

and is more nutritious. In the lowlands coffee is not planted for the berry, not being sufficiently productive, but for the leaf; the people plant it round their houses for their own use. It is an undoubted fact that everywhere they prefer the leaf to the berry." So far, but little success has attended the efforts to introduce the coffee leaf into general use in Europe, and I am not aware that any has ever been brought to this country.

The coffee which grows upon dry and elevated spots, is smaller and better, but all the varieties are greatly improved by age, and the poorest coffee by long keeping becomes equal to the best. This is supposed to result from slow chemical changes taking place with the seed, by which a larger quantity of the volatile oil, to which the flavor and aroma are due, is developed. This is still further augmented by the process of roasting, which should be continued only until a uniform light brown is obtained. Coffee in roasting loses in weight, but gains in bulk sometimes to the extent of fifty per cent. The loss of weight is usually from fifteen to twenty-five per cent.

The active constituents of roasted coffee are chiefly the caffeine, which is identical, as stated in the previous chapter, with the theine of tea, a brown, bitter principle, and the volatile oil. Both the essential oil and the bitter flavor are developed from one

of the soluble constituents of the berry, since the aqueous extract of the raw berry, when roasted, acquires the full odor and taste of coffee.

The proportion of the aromatic oil in roasted coffee, according to Payen, is only about one five-thousandth, by weight. Coffee also contains a considerable quantity of fixed oil, and an astringent acid allied to the tannic, but differing from the ordinary kinds in some of its properties. The following is a statement of the average composition of raw coffee: —

Woody matter	34
Water	12
Fatty matter	13
Gum, sugar, and caffeic-acid	18
Caffeine	2
Azotised matter, analogous to legumin	13
Saline matters, essential oil, etc.	8
	100

These saline matters are chiefly salts of potash, the carbonate and phosphate. The sugar in raw coffee varies from six to nearly eight per cent., and is mostly converted during the process of roasting into caramel; this is the principal coloring matter which gives to the decoction of coffee its rich appearance, and also most of its bitterness, and in the adulterated article, where beans, peas, or grain are employed, sugar is artificially added to give the necessary color. When roots, which themselves

contain sugar, in even greater quantity than coffee, are used, this is not required. *Legumin*, which exists in considerable proportion in coffee, is a nutritious substance which is found in the almond, and in the seeds of most leguminous plants (beans, peas, etc.). It forms as much as one-fourth of the weight of dried peas, and is very similar to (according to Liebig identical with) *casein*, the cheesy matter of milk. This may account for the practice among the Arabs and other oriental nations, of swallowing the grounds with the decoction: in the countries of Central Asia the use of animal food is rare, and hence the inhabitants may have been instinctively led to prepare their coffee in such a manner as to enable them to use the substance in some measure as a substitute for the nitrogenous constituents supplied by a flesh diet.

It may, perhaps, be interesting to mention, as among the curiosities of chemistry, that a most magnificent purple dye, called caffeo-murexid, can be prepared from the alkaloid (theine) of tea and coffee. It is analogous to the dye which produced the famous Tyrian purple, unsurpassed for its perfection and permanence of tint, and which was originally obtained from a species of shell-fish, but is now prepared from the drainings of barns, etc. While this may not account for its *stable* character, it is certainly one of the most indestructible as well

as one of the most brilliant of dyes, and consequently held in great admiration, though probably few of my fair readers who wear it, are acquainted with its source. As from the same locality, however, are derived some of their choicest and most delicate flavors and perfumes, they will hardly reject its beauties, even when informed of their ignoble origin.

The best series of experiments upon the physiological effects of roasted coffee, as well as of its essential oil, and of caffeine, are due to Julius Lehmann, who watched for some weeks their effects upon two individuals in good health (Liebig's *Annal.* lxxxvii. 205). The use of coffee as an article of diet would appear, from these experiments, to exercise an important influence in retarding the waste of the tissues of the body; since it was found that during its use, the proportion of phosphoric acid and of urea (some of the ultimate forms which the constituents of the tissues assume in their retrograde metamorphoses) excreted by the kidneys, was much smaller than when the coffee was omitted, the diet being in all other respects the same in both cases. Thus it was found that when an infusion of three quarters of an ounce of roasted coffee was taken daily for a fortnight, the average proportion of urea and of phosphoric acid which passed off by the kidneys in twenty-four hours, was less by

one third than it was during a similar period in which the coffee was omitted. The empyreumatic oil of the coffee was found to exert a stimulating effect upon the nervous system. When too large a quantity of this essential oil was taken, it produced loss of sleep, nervous excitement, and symptoms of congestion of the brain. In smaller quantities it produced a gentle perspiration, removed the sensation of hunger, and acted upon the bowels as a laxative. It likewise reduced the amount of effete matter in the renal excretions. — (Miller.) The effects of caffeine, or theine, have been already mentioned in speaking of tea; they are precisely the same, whether the alkaloid be obtained from tea or coffee; and no doubt one reason for the superior *strength* or stimulating effect of coffee, is due to the fact that its empyreumatic oil possesses stimulating properties in a much higher degree than the essential oil of tea, and thus materially adds to the effect produced by the caffeine.

Although coffee and tea may, as has been stated on authority, be useful in arresting a too rapid waste of the tissues, their chief value, and unquestionably the cause of their extended use as alimentary substances, lie in their power of stimulation, a craving necessity for which appears to be universally characteristic of the human race. The quality of arresting waste, would seem to be antagonistic to the

undeniable stimulative powers of coffee ; for these, by inducing increased action must, it would seem, in all cases cause an augmentation in the amount of the effete matters to be excreted; and consequently the correctness of Lehmann's observations and deductions on this point have been questioned. More extensive and varied experiments are needed before the question can be regarded as settled.

Roasted and ground coffee is very largely sold by grocers throughout the country, and as extensively adulterated with various substances, to increase its bulk and augment the profits on its sale, not only at the expense of all its most valuable qualities, but to its injury by the addition of that which is actually hurtful.

One of the most common adulterations of coffee is the root of chicory (*cichorium intybus*), succory, or wild endive ; a plant belonging to the same family as the dandelion, and growing wild in abundance by the roadsides in the neighborhood of Boston. Whether the coffee-grinders depend upon this natural supply, or import their stock chiefly from Europe, where it is extensively cultivated, or whether there are plantations of it in this country, I am not aware; but at any rate we find it to a great extent in the ground coffees. Perhaps the dandelion root, which does not differ greatly from chicory, either in qualities or structure, may also be used.

It is contended by many of those engaged in the business, and to a considerable extent believed by the public, that chicory is an improvement to coffee, and that at any rate it is harmless. I shall show that both of these assumptions are false. If chicory were an improvement when mixed with coffee, it ought to be good by itself; but any one who has tasted the bitter, muddy, and nauseating infusion of this root, is aware that only when mixed and partially disguised with coffee can it be drank at all. It contains no essential oil, tannic acid, or alkaloid, analogous to that of coffee. Between the two articles, therefore, there is no analogy whatever; but chicory has active properties of its own, which are markedly injurious. Professor Johnston, whose views, says Dr. Hassall, appear more favorable than the facts warrant, thus expresses himself in regard to roasted chicory: "It possesses in no degree the pleasant aroma which recommends the genuine roasted coffee. Its active ingredients are, first, the empyreumatic volatile oil" (existing, says Dr. Hassall, only in infinitesimal quantity); "this is produced during the roasting; and though not so fragrant, this oil probably exercises upon the system some of the gently exciting, nerve-soothing, and hunger-staying influence of the similar ingredients contained in tea and coffee; and second, the bitter principle. When taken unmixed, this substance is

to many, while they are unaccustomed to it, not only disagreeable, but nauseous in a high degree. It may, however, like many other bitter principles, possess, as I have said, a tonic or strengthening property. Taken in moderate quantities, these ingredients of chicory are probably not injurious to health, but by prolonged and frequent use, they produce heartburn, cramp in the stomach, loss of appetite, acidity in the mouth, constipation with intermittent diarrhœa, weakness of the limbs, tremblings, sleeplessness, a drunken cloudiness of the senses," etc. etc. Many cases are given in which the use of chicory, either alone or mixed with coffee, produced heaviness, headache, and diarrhœa.

It is the opinion of the eminent oculist of Vienna, Professor Beer, that the continual use of chicory seriously affects the nervous system, and gives rise to blindness from amaurosis.

In addition to chicory I have found, in the samples which I have examined, another root, which is probably carrot, and which, I am inclined to believe, is more extensively used than chicory. Peas and beans are also largely used. I have been informed by a gentleman who professes to be acquainted with the details of the business, that in some of the burnt and ground "coffee" there is only twenty per cent. of coffee, the remainder being made up of chicory and peas. I have not yet seen any in which the

fraud has been carried to so great an extent, — the worst which was examined being about one half coffee, and costing only two cents a pound less than that which was genuine. And here is the secret of this, as of all similar rascalities; it gives a larger profit to both grinder and dealer, who, thoughtless or regardless of honesty and of the health of their customers, sacrifice both to dishonorable gain. This fraud may even assume murderous proportions, for it is well-known that coffee is one of the most powerful and available antidotes in poisoning by opium, while the administration of a mixture of chicory and peas, totally without effect, might sacrifice the valuable time upon which a life depended.

The following is the analysis of six samples of coffee purchased at six successive stores on one street in Boston: —

1.	Price 20 cts. per pound,				slightly adulterated with chicory.
2.	"	18 "	"	"	adulterated with carrot and beans.
3.	"	18 "	"	"	much adulterated with chicory.
4.	"	22 "	"	"	genuine.
5.	"	18 "	"	"	very much adulterated with carrot and peas.
6.	"	20 "	"	"	genuine.

Many subsequent examinations of samples of burnt and ground coffee sent to me from different places, confirm the conviction that but little pure coffee is sold in this form, and every family should, as their only sure protection, purchase their coffee unground

There are several simple tests by which the presence of chicory and other roots may be detected in coffee. In the first place pure coffee parts with its coloring matter very slowly to cold water; while the roasted roots, being of a softer texture, impart to it, almost immediately, a color as deep as that extracted from coffee by boiling. The rapid softening of the roots also affords another easy test. By moistening the sample to be examined, and allowing it to remain for a few minutes, the softened particles may be picked out with a pin or the point of a knife, while the coffee remains unaffected. The application of these tests will soon satisfy purchasers that my statements upon this subject are not overdrawn.

Peas, beans, and grain are not so easily discovered, although their fragments may be occasionally picked out from the coffee by their shape. The microscope is necessary here, in order to show satisfactorily the presence of these substances; and for its application I must refer to Dr. Hassall's "Adulterations Detected," wherein the reader will find engraved representations of the microscopic appearance of coffee and of the various substances used in its adulteration.

The Cocoa (*Theobroma cacao*) like the tea and coffee trees, is a small evergreen, rarely exceeding twenty feet in height. It grows spontaneously in Mexico, Central and South America, and the West

India Islands, sometimes forming whole forests. It produces its fruit, resembling a long thick cucumber, throughout the year, and the seeds of this fruit, when properly prepared, constitute the cocoa-bean of commerce.

When the Spaniards first established themselves in Mexico, they found a beverage prepared from this seed in common use among the natives. It had been used by them from time immemorial, and was known by the name of chocollatl. The Spaniards brought it to Europe in 1520, and it has since been adopted as a beverage, to a greater or less extent in most civilized countries. It was a favorite drink of the great botanist Linnæus, who bestowed upon it the generic name of Theobroma — Food for the Gods.

The cocoa fruit grows, like the fig, directly from the stem and principal branches. It contains from six to fifty seeds; in Central America, where the tree thrives best, the latter number is not uncommon, while in the West Indies, and in Berbice and Demarara, the fruit is small. These seeds are about the size of an almond kernel, but thicker. The pulp which encloses them is of a pink color and sweet taste, something like that of the watermelon, and is used as food. The harvest is in June and December, when the fruit is gathered, and the seeds separated and dried; being in some countries allowed

previously to ferment slightly, which has the effect of lessening their bitterness, and otherwise improving their flavor.

The beans are prepared for use by roasting, like coffee. When the aroma is well-developed, the beans are turned out and allowed to cool. The outer husk, which splits off during this process, is sold separately under the name of shells. The beans, broken into fragments, are known in the shops as cracked cocoa (in England, cocoa nibs), and when finely ground, as cocoa, cocoa-paste, broma, and chocolate.

Cocoa contains a white crystalline substance, similar to but not identical with theine. It is called by the chemists *theobromine*, and its effect upon the system does not vary materially from the active principle of tea and coffee. There is also a small quantity of volatile oil, and coloring matter, but what especially distinguishes cocoa from tea and coffee is the presence of a considerable quantity of starch, and the large amount of fatty matter which it contains. These two constituents make it much more nutritious than tea or coffee, and remove it from the class of simple stimulants, into that of the preëminently elementary substances. The following as the average composition of the cocoa bean when freed from the husk, is given by Prof. Johnston: —

Water	5
Starch, gum, etc. . .	22
Gluten, etc. . . .	20
Oil (cocoa butter) . .	51
Theobromine . . .	2
	100

Cocoa is rich, therefore, in all the important nutritious principles which exist in our most valued forms of ordinary food. It resembles milk very closely in its composition, differing chiefly in the greater quantity of fat which it contains, and in the presence of the theobromine and volatile oil. It thus unites in itself the exhilarating properties of tea with the strengthening and ordinary body-supporting qualities of milk. — (JOHNSTON.)

Cocoa is adulterated by being mixed with cheaper articles, such as sugar, starch and flour, fats and earthy substances. These, when added in considerable quantity, make it of a lighter color, and to remedy this, Armenian bole, oxide of iron, Venetian red, and other ferruginous earths are added. These latter are sometimes contaminated with *arsenic*.

No excuse exists for any of these additions; they are wholly and entirely fraudulent, and are added for the sole purpose of increasing the profits of the manufacturer, or to enable him to undersell his rivals. There is, perhaps, one exception to this, in the addition of a certain quantity of starch, for the purpose of retaining the oil in suspension, that it

might appear not to be present; but this is a deception in itself, of which more will be said further on.

I have examined numerous specimens of French, English, and American cocoa and chocolate, and am pleased to be able to state, that the American article, particularly that prepared in the vicinity of Boston, is not only the cheapest, but by far the purest and best. All the American specimens sold as pure cocoa were actually so, and appeared to be made from sound and sweet beans. The American chocolate was also pure, except where it was sold as sweetened, or spiced.

The French chocolate was also good, but higher in price than the American.

On the contrary, all the English specimens which I have been able to procure, were abominably adulterated; containing a great deal of sugar and starch, and scarcely fifty per cent. of cocoa. When incinerated, the ashes, by their red color, showed the presence of large quantities of earthy coloring matter. Some of these specimens, put up in tin-foil, with very gay labels and sold at a high price, bore the name of a firm who were published in the London *Lancet*, some years since, for their unblushing frauds in this article; apparently without any other effect than sending them to seek a market for their adulterated wares in this country. It is best to buy no English cocoas or chocolates whatever; for the

domestic article is in every respect both better and cheaper.

I am sorry to have found one exception to the general good character of American cocoa; and that too, ushered before the public under the recommendation of most respectable medical authority. An article is alluded to which is sold as "cocoa paste." This does not claim to be pure cocoa, and is not complained of so much for adulteration, as for the misrepresentation which it bears upon the label. This states in one place, that the oil of the nut, "so offensive to many in the ordinary cocoa preparations, is in this entirely neutralized:" and in another place, bears a certificate in which "the absence of the oil of the nut," is stated as a reason why it is a valuable improvement over other cocoa preparations. This statement, signed by physicians of the very highest worth and distinction, is made, evidently, not from an analysis, but in reliance upon the statement of some person, probably the manufacturer.

I have carefully analyzed the "cocoa paste," and find it to consist of a very excellent cocoa, ground much finer than usual, so that most of the cells of the nut are broken up, and the starch (of which cocoa has naturally about eleven per cent.) liberated. These starch corpuscules of the cocoa are extremely minute, and as the nut is ordinarily ground, a large proportion of them are not set free. In the cocoa

paste there is nearly if not quite the full proportion of oil; and as the natural starch of the nut is not sufficient, even with the perfect trituration which it has received, to hold the oil in suspension, a considerable quantity of potato starch has been added, and is easily distinguished under the microscope. The paste is sweetened apparently with a good quality of sugar; and the ash is of a grayish white, indicating that no mineral coloring matter has been added.

There are unquestionably cases where it is desirable that a cocoa should be taken that has been deprived of all or a greater portion of its oil; which, although one of the most digestible of fats, is yet sometimes likely to disagree with the feeble stomach of an invalid. Now while it is not my intention to charge the manufacturer of this article with a deliberate intention to defraud, for he may suppose that the suspension of the oil by the starch is equivalent to "neutralization," I am yet bound to say that it does not fill the place for which it is intended. It is not better, indeed it is not so good for the purpose, as the same manufacturer's Pure Cocoa. If this is boiled and then set aside for a few minutes, a great portion of the oil will rise to the surface, and may be removed. But the best and lightest preparation of cocoa for the sick is made either from the shells, which contain hardly any oil, or from the cracked

cocoa, which being broken into large fragments, does not permit of its free escape. This may also be sweetened much or little, or not at all, as suits the individual taste; which is precluded in the case of the paste, by the large quantity of sugar which has been added in its manufacture. This is, in some cases, fully as objectionable as the oil.

I conclude the subject by repeating that the American cocoas and chocolates, so far as I have examined them, are by far the best in the market; and that none, with that one exception, stood the tests applied more satisfactorily than those of the firm whose preparations I have felt it incumbent upon me, in fulfilment of the task I have undertaken, to criticize above.

CHAPTER IV.

ADULTERATIONS OF BUTTER, LARD, HONEY, SUGAR, PEPPER, SPICES, MUSTARD, AND CAYENNE.

One of the most frequent practices had recourse to (says Dr. Hassall) in the case of butter, is to incorporate with it large quantities of *water;* the incorporation is effected in the following manner: the butter is brought to the melting point, water and *salt* are then stirred in until the mixture becomes cold.

In reference to the adulteration of butter with water and salt, Professor Calvert, in his evidence before the Parliamentary Committee on Adulteration, made these remarks: "The quantity of water and salt that such an article as butter ought to contain is two and a half per cent. of salt, and ten per cent. of water. In the butter supplied to these unions, the quantity of salt varied from two up to fourteen per cent., and the water from ten to fifteen per cent."

I have often found in the markets butter in which water appeared to have been mixed by a process similar to the above, and every one is aware of the

excess, sometimes very great, in which salt is added to this article. But the most common adulteration of butter in this country is a rare one in England — the mixing of lard with it, often to the extent of thirty per cent. In that country lard is usually too near in price to butter, to enable it to be used profitably for adulteration; here that is not the case, and accordingly it is often employed.

It is chiefly to the poorer classes and in the meaner shops and stores that adulterated butter is found for sale, although this is by no means uniformly the case. I have known not a few instances in which such an article has been sold by some of the largest and apparently most respectable provision dealers. In one such case, and the only one in which I have known that substance to be used for the purpose, the butter contained a quantity of flour.

The detection of the presence of water in butter is easy. As butter is usually washed with water when taken from the churn, to remove the whey, a small quantity will always be found in it. To ascertain how much water a certain quantity of butter contains, it should be melted and poured into a bottle. This should be kept near the fire for some time, that the two substances may be completely separated; when the water will be seen at the bottom, generally milky from the presence of whey, and

the butter at the top, and the proportion of each may be estimated by the eye.

The presence of an excess of salt is easily detected by the taste. The detection of flour and of lard is not always easy by simple tests; the microscope is often necessary for this purpose, under which the starch granules of the one, and the crystals of margaric and stearic acids in the other, demonstrate their presence. When present in large quantities, lard is detectable by its taste, and flour by its burning and sticking upon a hot griddle.

The fraud of mixing with water is much more largely practised in lard, than in butter. The proportion is often carried as high as twenty-five per cent. and the abuse has become so great that the press, particularly in New York, has repeatedly called public attention to it. Salt is also used to a considerable extent. In butter a certain quantity of salt is usually expected; but there is no necessity and no excuse for mixing it with lard, which if good in the first place, and properly prepared, keeps perfectly well without it. Water may be detected in lard in the same way as in butter. One fact as to the different grades of lard, is not generally known to retail purchasers, and may be useful to them. The "*No.* 1 *Lard*" of the western packers is not the best, but the poorest quality; it is soft and oily, and is made solely from the fat of the intestines. The

better qualities are those branded "*prime*" and "*leaf;*" the former made from the whole hog exclusive of the intestines; and the latter from what is usually known as the "leaf." These two latter brands are often put up in kegs, the former only in barrels and tierces.

Flour is occasionally added to lard, but not very extensively, as it is easily detected in frying by its burning and sticking to the griddle. All of the adulterations of lard are practised by the small dealers and farmers; a long and extensive acquaintance with the Pork-Houses of the West, enables me to state that the greatest pains are taken there, to have the lard carefully and cleanly prepared, and thoroughly freed from water.

Factitious and adulterated honey is very common in our markets. The substances used are generally ordinary sugar, made into a syrup with water, and flavored with different articles. This preparation is usually mixed with genuine honey, and so extensively is this fraud practised, that very little "strained honey" can be found which is pure. The only absolutely injurious adulteration, as regards health, which I have found in such honey is alum; but it is unsafe to trust rogues, and doubtless if those who engage in the business should find that by using a deadly poison they could produce a better imitation, they would not hesitate to employ it.

I have placed, in the table, glucose, or starch sugar, among the adulterants of honey, on the authority of an able chemist of this city; but the fact that the sugar of honey is identical with it, makes it very difficult to detect, and I have, myself, never verified its presence. "As glucose is usually made by boiling with sulphuric acid, and as the excess of this is sometimes neutralized with chalk, the presence of considerable quantities of sulphate of lime affords strong evidence of adulteration with sugar of starch." — (HASSALL.)

Many of my readers have doubtless noticed in the newspapers advertisements of recipes for making "Honey without Bees." As a matter of curiosity I give one of these advertisements, with the recipe annexed, which cost the sum of one dollar, and which the reader is welcome to, with the advice that if he tries it, it had b tter be done with a small quantity of materials, to save waste.

ARTIFICIAL HONEY. — One hundred and fifty per cent. can be made upon the sale of this article, and that too when sold at a less price than honey made by bees. It can be made in small quantities for six cents per pound. By an expensive and accurate chemical analysis (having gone to immense expense to analyze pure honey, made by the bee, and to get at purely the constituent parts of each article in the numerous catalogue of components of which this delightful household article consists, to enable us to give you this valuable substitute), and by a series of costly experi-

ments each of the numerous ingredients which enter into the composition of pure honey, and the relative proportion of each have been discovered, so that this delightful household article can be produced in any quantity and at a mere trifling expense, as compared with its present price. The honey made by this process, is equal in every respect, and has been pronounced by competent judges, to be superior in flavor to the best honey made by bees, and it cannot be distinguished from it except by chemical analyzation. All the materials for making it can be procured in every country village, and no apparatus is required beyond what is found in every farmer's kitchen. The total cost of honey made by this process, will not exceed six cents a pound. Every article used in the manufacture is perfectly wholesome, and the honey is found by analysis to be precisely the same in chemical composition as that made by the bees.

Recipe.— Take ten pounds of Havana sugar, three pounds of water, forty grains of cream tartar, ten drops of essence of peppermint, and three pounds of honey. First dissolve the sugar in the water, over a slow fire, and take off the scum arising therefrom; then dissolve the cream tartar in a little warm water, and add the same stirring; then add the honey heated to a boiling pitch; then add the essence of peppermint, and stir for a few moments. Let it stand until cold, when it will be ready for use.

These imitations are poor, yet, aside from the suspicion which their taste gives rise to, they are not certainly detectable, except by chemical and microscopic tests of considerable nicety. For these, as for all tests of a similar description, I must refer my readers to the elaborate work of Dr. Hassall. The

only absolute safety in the purchase of honey, is to buy it in the comb.

The only adulteration of sugar which I have detected, is the admixture of flour with finely ground white sugar. The sugar-refiners seem to confine their tricks to this variety of their product, and the liberty they take with it is often proportionally great. A lady friend of the author recently told him that, in an attempt to make some syrup for preserving purposes with powdered sugar, she found the result to be *starch* instead of syrup. I have never found any adulteration in the loaf, lump, and granulated refined sugars, and nothing in the brown kinds except ordinary and accidental impurities incident to the processes of manufacture, etc. The presence of flour in sugar is detected by dissolving a portion in water; the flour remains suspended at first, making the water turbid, and, if left to stand, it settles to the bottom of the vessel.

Pepper, the different spices, mustard, and cayenne, are usually sold in powder; giving an opportunity for the commission of two kinds of fraud, both of which are carried to an enormous extent. The first consists in grinding up damaged and unsalable goods, such as have suffered injury from water, insects, etc. In every city where a large trade is carried on in these articles, a certain quantity of them must arrive from the countries in which they

are produced, in a more or less damaged state. Many goods are also impaired by long keeping, storage in damp places, and the ravages of insects. Some of them are only injured in appearance, but by far the larger quantity suffer essential detriment in those qualities for which they are chiefly valued. How few of us think, or even know, that the spice which flavors our food, may consist in great proportion of the debris and excrement of the insects which have preyed upon it; of the dirt of filthy gutters, where the bags containing it have been thrown, when taken from a burning warehouse; or is impregnated with the vile water of the docks which has been cast upon it from the fire-engines, under similar circumstances. Add to these the products of mould, mildew, and partial decay, and it seems that sufficient motive is offered for the preparation of these substances at home, from supplies purchased in that condition, in which deception as to quality is impracticable.

The reader must not suppose that the quantity of such inferior goods is small; or that, as a general thing, the damage which they have suffered is trifling. Any one acquainted with the trade in these articles, is aware that the reverse of this is true. In fact, so much of these filthy and comparatively worthless condiments is ground up for sale, that when sound articles are taken for that process, so-

phistication is necessary in order to compete successfully in price. These are either mixed with the poorest damaged goods, or with entirely extraneous substances.

The detriment, by accident or design, which spices, etc., thus receive, is often accompanied by a change in their appearance, which leads to the admixture of a second class of adulterants, designed to give them a genuine look. These are sometimes harmless as regards health, but more frequently they are hurtful, and sometimes poisonous. It may be set down as a fact, that a man who will practise such rascality as we have described, will not hesitate to conceal his crime, even at the expense of the health or life of his victims.

And here it seems proper to say a word to the class of persons, decreasing in number, it is true, but far from extinct, who say so frequently to the man of science, "what is the use of all your so ardently pursued studies? where are the benefits which pay for health destroyed by exposure to the poisonous gases of the laboratory; for eye-sight ruined by midnight study, or constant poring over a microscope in search of the minute structure of plants and animals?" I think there can be shown them, right here, a portion of the good which is attained, and which must be appreciated by the most "practical" mind.

Only ten years ago the officers of the English excise testified, and the Chancellor of the Exchequer, Sir Charles Wood, reported to Parliament, that *no means existed* for the detection of many of the most glaring and injurious frauds which are perpetrated in the adulteration of food. The public were actually quite at the mercy of all these wholesale poisoners and robbers. But Dr. Hassall turned the powers of chemistry and microscopy upon them, and behold the result. The *Quarterly Review* for March, 1855, says: —

> A gun suddenly fired into a rookery could not cause a greater commotion than did this publication of the names of dishonest tradesmen; nor does the daylight, when you lift a stone, startle ugly and loathsome things more quickly than the pencil of light, streaming through a quarter-inch lens, surprised in their native ugliness, the thousand and one illegal substances which enter more or less into every description of food which it will pay to adulterate. Nay, to such a pitch of refinement has the art of fabrication of alimentary substances reached, that the very articles used to adulterate are themselves adulterated; and while one tradesman is picking the pockets of his customers, a still more cunning rogue is, unknown to himself, deep in his own.

All, or nearly all these villanies are perpetrated right here, in our own country, as can be demonstrated to the satisfaction of the most sceptical. They are not perhaps carried to such a height, nor become so thoroughly systematized as they were in

England; but now is the time to suppress them, before the interests concerned have become so extensive, and the ill-gotten wealth so great, as to be able successfully to resist the efforts made for the protection of the people. Here is a chance for "practical men" to take up the matters which men of science lay before them, and demonstrate *their* usefulness to society by devising and carrying out adequate means to so necessary an end.

I have found that, as a general rule, the cheaper the spice the less is it adulterated. This might have been presumed, yet even the cheapest ground spices, such as ginger and pepper, are rarely pure and of good quality. The former, besides being ground from injured roots, is adulterated with damaged flour, and colored with turmeric. I have found remains of insects, and their debris, in several samples. It is often very deficient in strength, to remedy which cayenne is sometimes added.

The samples of ground pepper which we have examined, were all mixed with wheat flour, and occasionally with dirty and earthy substances, as though the pepper had been spilled upon the ground and carelessly shovelled up; at least the quantity was not so great, or its occurrence so general, as to lead to the inference that the dirt was added purposely.

Allspice, or pimento, is also adulterated with flour,

although we have found quite a number of samples which were unmixed. Perhaps the demand does not much exceed the supply of damaged berries.

Cloves are adulterated with some kind of bark, the stellate cells peculiar to many barks being quite numerous in some samples. Those which appeared to be genuine, were yet very deficient in strength, having been either much damaged, or subjected to a process which is said to be common, of extracting a portion of the essential oil before grinding.

I purchased several samples, labelled "cinnamon," none of which contained a particle of that spice. They were all the much inferior and cheaper article, cassia; in many cases damaged, and in all mixed either with corn or rice flour. Two samples were colored with ochre, and many were almost tasteless. Samples labelled "cassia," did not differ from the cinnamon. Cayenne is used most extensively, both as a condiment and as a medicine; yet it can rarely be obtained pure, even of druggists. Corn meal and salt seem to be the favorite adulterants; it is often colored with venetian red, or other ferruginous earth, and not unfrequently with *red lead*. After testing three samples for lead without result, except to lead us to hope we should not find it at all, in the fourth it was detected in considerable quantity by chemical re-agents, and afterwards picked out of the same sample under the microscope. How many cases of

lead palsy, or of the frightful "*Colica Pictonum*," the origin of which it has puzzled physicians to trace, and which at last have been erroneously attributed to some other cause, really depended upon the poisonous cayenne which many persons consume in large quantities, it would be difficult to say. Doubtless such cases have often occurred, and now occur; for surely if, as has been well authenticated, strongly marked cases of these diseases have resulted from passing a single night in a freshly painted room, enough, and far more than enough of the poisonous mineral was contained in the cayenne examined, to produce the same effect. It is a strange thing if people will submit to such risks for themselves and their families, when the remedy is in their own hands. Which of my readers knows that he is not planting the seeds of pain, misery, and an agonizing death, when he supposes he is merely sprinkling a pleasant stimulant to digestion upon his beef-steak?

Mustard, used like cayenne, both by the cook and the physician, is like it also in being rarely found pure in the shops. In fact, I am informed that grinders have a regular scale of adulteration, understood by themselves and the trade, though, I am convinced, not by the public. The most common impurities are flour and turmeric: the latter added to restore the color, which is partially lost by the large quantity of flour added, amounting in many cases

to considerably more than fifty per cent. Most of the samples examined consisted of black mustard seed; some, however, contained the white alone, while others consisted of a mixture of both. They are easily discriminated under the microscope, and indeed by the eye, after a little experience.

This weakening of mustard by the addition of flour is not alone a fraud upon the pocket: like the adulterations of coffee, it has its murderous aspect, well worthy of attention. Mustard is one of the promptest and most effective emetics, and one which, from its being almost always at hand, would, if it could be depended on as pure, be often the chief reliance of the physician in cases of poisoning. Yet such is the uncertainty of its action, as usually found, that no medical man dares to depend upon it, except in the absence of every other remedy. How much invaluable time is often lost in sending off for some other article, is known perhaps only to physicians themselves. In some other distressing and dangerous attacks, the prompt application of a mustard plaster is frequently of the first importance; yet for the same reason this is often without avail. I have seen cases where a mustard plaster failed to produce even a slight redness of the skin after half an hour's application. Every family should keep a constant supply of pure mustard, carefully preserved from deterioration in a tight bottle or can, for such emergencies.

It has been stated that among the substances used to color adulterated mustard, the chromate of lead (chrome yellow) was included. I have not been able to detect it in any of the samples examined. Our only protection against it at present, however, is in the fact that it is probably not found to *pay*.

In conclusion, I would call attention to a most convincing and self-convicting fact, made plain by druggists' and grocers' prices-current; where powdered substances are frequently quoted at less prices than those which are whole, notwithstanding the known loss and expense of grinding. "Comment is unnecessary."

CHAPTER V.

ADULTERATIONS OF CONFECTIONERY, VINEGAR, PICKLES, PRESERVED FRUITS, MEATS, AND FISH. "*Δεινα περι φαγης.*"

PUBLIC attention has been repeatedly called to the adulterations which are noted at the head of this chapter, and perhaps every one of my readers is aware that most of the articles named are the subjects of dangerous sophistication. The newspapers occasionally publish articles in regard to these frauds, but the impression made thereby is light, and quickly fades out from the public mind.

Yet nothing can be of more importance to the public than pure food, and especially pure food for their children. Life in its outset is surrounded with perils, many of which are unavoidable. In Boston, and in most other cities and large towns, two thirds of the children die without arriving at the age of five years. Defective organization from hereditary or unknown causes; the perils of birth; the scourging maladies peculiar to or most common among the young; defective nourishment and an impure

atmosphere; these and many other agencies combine to besiege the gateway and entrance of life, and through them each of us has had to, and every one of our children must, run the gauntlet beneath the blows of which so many sink and perish.

If we add to all these dangers the constant administration to these tender beings of active and virulent poisons; if in the milk offered to them as a substitute for that which through necessity the mother cannot or through fashion will not afford, a fatal source of disease shall lurk; if in the gay and tempting sweets so dear to youthful palates, death lies in its most hideous and agonizing form, "who can wonder that the infantry of heaven should far outnumber the grenadiers?" — who can be surprised that among the shades that crowd the banks of the dark river, so many untimely ghosts are wailing for the mothers from whose despairing breasts they have drooped and fallen, smitten by a pitiless but unseen hand?

Upon the innocent children, indeed, the whole toxical battery seems to have been concentrated with Herodian intent. In a subsequent chapter, the subject of poisonous milk will be discussed; in this, I wish, first and chiefly, to call attention to the villanies of the confectionery trade.

The colors which are principally employed by confectioners are yellows, reds, browns, purples,

blues, and greens; and I state distinctly that I have verified the presence, by carefully applied tests, of all the following articles in confectionery bought in Boston.

Yellows.— Chromate of lead (chrome yellow) of different shades, and gamboge. The former is a most deadly poison. Even in very small quantities it is capable of producing the most alarming symptoms. In speaking of the effects of red-lead in Cayenne, the poisonous action of the salts of lead upon the human system was alluded to. Dr. Beck in his "Medical Jurisprudence," says: "I cannot too much impress upon my readers the necessity of being well acquainted with the symptoms produced by the compounds of this metal (lead), and the tests necessary to detect them. In the course of my remarks it will be seen how often they have produced injurious or fatal effects from being united with very many articles of common food and drink." Of all the different causes of poisoning which come under the notice of physicians, lead, in some form, is by far the most common, and its source often the most difficult to trace.

Among the earlier symptoms of lead poisoning are the following; — a dryness of the mouth and nostrils, a tendency to costiveness, impaired appetite, colicky pains, and sometimes nausea and vomiting. A sweetish astringent taste, and a peculiar

offensive odor of the breath are said to accompany the poisonous action of lead. The circulation is depressed and the mind dejected. This condition may exist for a long time without any other very striking symptoms, but more frequently violent abdominal pains, obstinate constipation, and all the agonies of what is known as "the painter's colic" succeed. Sometimes, perhaps, the action of the poison may be chiefly expended upon the brain and nervous system, and then we have agonizing neuralgias, weakness, and paralysis, especially of the arm and wrist, — what is commonly called "wrist-drop," or the *falling hand*. This action may be extended to the lower extremities, counterfeiting rheumatism in all the joints, or causing trembling of the muscles and an uncertain, staggering gait. But by far the most serious effects of lead are *those upon the brain*. They usually occur at the close of protracted cases; but sometimes early, either by themselves, or associated with colic or palsy. Among the most prominent are convulsive attacks, similar to those of epilepsy, which are generally fatal. Sometimes the muscles become cataleptic; and sudden seizures imitating apoplexy now and then occur. Impaired sight and hearing, complete blindness, delirium and stupor are usually the last effects of the poison. — (Wood.)

The chromate of lead is one of the most active

of all the forms in which that metal presents itself, and yet it is used unreservedly in coloring confectionery. Gamboge, the other substance most commonly employed for producing a yellow color by confectioners, is a powerful, drastic purgative, so harsh in its operation as to be but little and carefully used by physicians — almost never administered to children, yet fourpence worth of yellow sugar plums may contain a full dose.

Reds. — The red most commonly employed is cochineal dye, not actually poisonous, but the juice of a disgusting South American insect, the *coccus cacti*. If people fancy such condiments, we have red spiders and aphids enough here at home, whose colors are bright, and which are probably quite as nutritious as this Honduran plant louse. But cochineal is not the only red employed to embellish sweetmeats. We see in the shops quantities of "lozenges" (of all shapes except the lozenge) whereon are stamped amative or comical sentiments (likely enough to excite the *risus sardonicus*), in a deadly red — vermilion — the bi-sulphuret of mercury. I have never detected red lead.

Browns. — Generally ferruginous earths, Vandyke brown, umber, or Sienna; not in themselves actively poisonous if pure, but very apt to be contaminated, in the shops where they are sold, with other pigments by no means harmless. I have often seen the

same scoop used in drug stores for red lead and the ochres named, also for whiting, white lead, and arsenic; and the scales in which they are weighed are rarely cleansed with care. This is not particularly reprehensible, for it is not supposed that such articles are to be used in food; but the reader can easily see that there is no safety in the use of even comparatively harmless colors for this very reason.

Purple. — This is not a very common color. Antwerp blue, a modification of Prussian blue, is generally used.

Blues. — Prussian blue and ultra-marine are commonly employed; not either of them very actively poisonous, but still by no means desirable or harmless articles of diet.

Greens. — Here comes death. Brunswick green, or oxychloride of copper; verdigris, or di-acetate of copper; emerald green, or arsenite of copper (two poisons in one); mineral green, or sub-carbonate of copper; false verditer, or sub-sulphate of copper and chalk; greens formed by mixing chromate of lead with indigo or Prussian blue.

"It may be alleged by some that these substances are employed in quantities too inconsiderable to prove injurious; but this is certainly not so, for the quantity used, as is amply indicated, in many cases, by the eye alone, is often very large and sufficient, as is proved by numberless recorded and continually

recurring instances, to occasion disease and even death. It should be remembered, too, that the preparations of lead, mercury, copper, and arsenic, are what are turmed cumulative — that is, they are liable to accumulate in the system, little by little, until at length the full effects of the poisons become manifested. Injurious consequences have been known to result from merely moistening wafers with the tongue; now the ingredients used for coloring these include many that are employed in sugar confectionery; — how much more injurious then must the consumption of sugar thus painted prove, when these pigments are actually received into the stomach." — (HASSALL.)

In regard to the "emerald green," the following extract from the "Scientific American" for October 27, 1860, will illustrate the virulent nature of an article which yet in this country can be employed with legal impunity, even in articles of food: "The numerous cases of poisoning resulting from the employment of the pigment known as Brunswick green or arsenite of copper, has induced the French sanitary board to take measures to suppress its use in various arts, as those of the dyer, calico-printer, paper-stainer, etc. Many articles of ladies' clothing dyed with this pigment, artificial flowers, etc., have caused dangerous illness to their wearers. In light materials, as gauze, tarlatan, etc., this pigment is

shaken out in considerable quantities during dancing, or rapid motion accompanied with friction, and finds its way into the faces and nostrils of the wearers, producing the most alarming symptoms." A substitute, being a peculiar preparation of indigo, has been proposed, to replace the mineral greens, but the use of any coloring matter in confectionery, should be sternly discouraged, if for no other reason, because by no ordinary tests can a poisonous tint be distinguished from an innocent one.

"That deadly poisons, like the above, should be daily used for the mere sake of imparting color to articles of such general consumption as sugar confectionery — articles consumed chiefly by children, who from their delicate organization are much more susceptible than adults — is both surprising and lamentable. It is surprising, on the one hand, that the manufacturers of these articles should be so reckless as to employ them; and on the other that the authorities should tolerate their use.

"In other countries, some of which we are in the habit of looking down upon as being behind ourselves, manufacturers of sugar confectionery using injurious coloring ingredients are liable to penalties. In France the subject has been deemed of sufficient importance to occupy the attention of the Minister of Police and Council of Health, and M. Andral, in 1830, at the instigation of the Council, drew up a

report addressed to the Prefect of Police, on the dangers which may result from the use of colored sugar confectionery, and he suggested remedies. The result of this report was the issuing of an ordinance, in which the practice of coloring sugar confectionery was most emphatically denounced: the poisonous ingredients specified; the harmless enumerated; visits were made; penalties were inflicted: and it was further ordered that no confectionery should be sold, unless the papers in which it was enclosed were stamped with the name and address of the confectioner. Lastly, by this edict the venders were held responsible for all accidents occasioned by the confectionery or liqueurs sold in their establishments.

"Regulations more or less resembling the above are in force in Belgium and Switzerland; in Zurich, indeed, the use of coloring matters of all kinds is interdicted." — (HASSALL.)

The good people who sell us these confections, and whom Charles Lamb in one of his comico-cynical moods might have commended, for he once drank the health of "the good King Herod," are not all guilty through ignorance — they even stand upon their defence, and tell us they only poison us a little, and that people rarely die immediately from the effects of their wares. One even calls the just anxiety of the people upon this subject, "The Poison

Mania," and sneers savagely at those who have striven to arouse the public to their danger. They say the quantities of coloring matter used are "infinitesimal." Perhaps so; but I have myself scraped enough "Scheele's green" from one small sugar toy, to kill a rabbit in a few minutes. Case after case is recorded in the medical journals of fatal poisoning from such causes; and how many children have expired in sudden convulsions, where no one ever suspected the virulent cause in the apparently innocent, gaily-colored sugar-plum, clasped in its little hand, perhaps even in its dying struggles. I write somewhat warmly upon this subject, for I happen to have seen one such case myself. I hope never to see another.

Sugar, in moderate quantities, is not injurious to children. Eminent physiologists even claim that it is advantageous, and their youthful cravings but the expression of a natural want of the system. But the observation of careful mothers, which they justly regard as worth more than the theories of books, convinces many of them that sickness almost invariably follows indulgence. It is probable that the facts and the theory may be easily reconciled, and that the trouble comes much more from the pigments than the sugar.

But there are other causes which render even uncolored confectionery not always harmless. White

powders, mineral and vegetable — gypsum, whiting, wheat and rice flour, etc. — are added to increase the bulk and diminish the cost of candies. Almost all the so-called lozenges, and the little sugared seeds of different sizes and shapes, are so adulterated. The flour does no injury, but the mineral powders are known to have a singular tendency to adhere to the intestines; not passing through with the other contents, but accumulating in the folds and curves of the bowels; forming concrete masses, which may by pressure ulcerate through the intestinal walls and escape into the abdomen; or cause an equally fatal result by totally obstructing the canal, producing what is familiarly known as "stoppage." Almost all pathological museums have specimens illustrative of this impaction of mineral powders in some part of the alimentary tube.

Some of the articles used to flavor candies are by no means harmless. Pineapple drops are said to owe their flavor to fusil oil. Other compounds of the same deleterious substance are made to imitate the flavor of pears and apples. "I have heard," says Professor Taylor, "that some of the Jargonelle pear drops, and the ribstone pippin drops have produced drowsiness and stupor in children. It is an imposition on the public to sell in this way a chemically flavored substance under another name." I remember having a severe head-ache which followed

the eating of a few "banana drops," and which I could attribute to no other cause. "A very fragrant, fruity essence," says Dr. Hassall, "may be produced from rotten cheese, by treatment with sulphuric acid and bi-chromate of potash."

Prussic acid is a common, though entirely unnecessary ingredient of the essential oil of almonds, and many fatal cases have resulted from its use. The Prussic acid is *not* essential to the flavor of this oil, and Professor Taylor remarks in his evidence before a Committee of Parliament, that "there is no excuse for selling prussic acid in these compounds, but laziness and ignorance."

Confectionery is often wrapped in paper colored with poisonous substances. Children will put such things in their mouths, and it is a danger which should be avoided.

The detection of the nature of the coloring and flavoring matters used in confectionery is not usually sufficiently simple or easy to be practicable by purchasers generally. The only safe way is to avoid *all colored confectionery whatever*, and all except the simple flavors with the nature of which we are acquainted, such as peppermint, vanilla, lemon, checkerberry, sassafras, clove, cinnamon, etc. The admixture of flour, starch, chalk, plaster, etc., may be detected by the method pointed out in the previous chapter in the case of sugar.

We might suppose that an article so cheap, and so easily and abundantly produced as vinegar, would escape adulteration. Indeed, as vinegar is a mixture of acetic acid with water, for which there is, we believe, no legal standard, it is not possible to fix a point at which we may positively assert that it contains too little acid, or, what is the same thing, too much water. But when we find the attempt made to supply the deficiency of acetic acid with a strong mineral acid — oil of vitriol — as is frequently the case, the guilty party is self-convicted. Not "Spaulding's Glue," nor any other colletic, can attach a character of honesty to such transactions. They could hardly be called "fair business transactions," even by the most liberal constructionist of the code of mercantile morals.

A law requiring that vinegar should contain at least four per cent. of pure acetic acid — I have found five per cent. in several samples which I have bought — would ensure to the public a good article, and at the same time do away with the inducement to adulteration with oil of vitriol. There is no reason why the law should not regulate the strength of vinegar as well as that of spirits; and as vinegar containing four per cent. of its proper acid is strong enough for all ordinary purposes, there is no temptation to adulterate with the object of giving it a deceptive acidity.

I find by analysis that a great part of the vinegar sold in Boston is very much below the strength named, and the presence of free sulphuric acid was shown by appropriate tests in several samples. In one the quantity was determined to be nearly one half of one per cent. Oil of vitriol is much stronger than acetic acid, and consequently a less quantity is needed to produce the requisite acidity. The quantity of acetic acid in this sample was under two per cent.

The subject of poisonous pickles has frequently attracted the attention of the public, and the fact of their existence, and the nature of the poison, have been repeatedly made known. But so long as silly people continue to prefer to buy pickles of a "beautiful green," so long will they be administering to their families a most virulent poison. There are no available substances known which will impart a bright and *permanent* green to pickles exposed to the light, except the salts of copper. These form the basis of all the "greenings" which are in use, and all the older cookery books contain recipes for their preparation. The following are some of these "deadly formulæ:" —

To pickle Girkins. — Boil the vinegar in a bell-metal or copper pot; pour it boiling hot on your cucumbers. — *Ladies' Library.*

To make Greening. — Take a bit of verdigris the bigness of a hazel-nut, finely powdered, half a pint of distilled vinegar, and a

bit of alum powder, with a little bay salt. Put all in a bottle, shake it, and let it stand till clear. — *Modern Cookery.*

To render pickles green, boil them with half-pence, or allow them to stand for twenty-four hours in copper or brass pans. — *English Housekeeper.*

The quantity of copper thus introduced into a common article of food, is sometimes perfectly frightful; sufficient even to produce death when partaken of in very moderate quantities. Numerous cases are on record of such results. The symptoms of copper poisoning in its less violent form are given as follows by Orfila: "An acrid, styptic, coppery taste in the mouth; parched and dry tongue; a sense of strangulation in the throat; coppery eructations; continual spitting, nausea, copious vomitings, or vain efforts to vomit; shooting pains in the stomach, which are often very severe; horrible gripes; very frequent alvine evacuations; with straining and debility; difficulty of breathing; cramps, cold sweats, headache, vertigo, faintness, etc. All of these, however, do not generally occur in the same individual, but vomiting and colic are very constant."

Now how often do people suffer from attacks like these, which are attributed to eating something which disagrees with them; not unfrequently to pickles; but then the trouble is supposed to be owing to their indigestibility; the possibility of

their being impregnated with a virulent poison not being suspected.

The pie fruits which are now so extensively sold in bottles, are often purposely tinged with copper to improve their appearance. None should be purchased which have a bright green color, an almost certain evidence of contamination.

There is a very simple test for the presence of copper in pickles and fruit, which any one may apply. This consists in immersing a piece of bright iron or steel in the vinegar or juice, and allowing it to remain there for a short time. It becomes more or less coated with a film of metallic copper. I think if my readers will try this experiment upon some of the contents of their closets they will be astonished at the results.

I have examined with considerable care, the pickles put up by a number of establishments, both English and American, and in over two thirds of the samples have found more or less copper. Some of them were of a dark, unnatural green, much deeper than when fresh, and contained an excessive quantity of the metal. In the pickles of one English and one Boston house, no trace of any poisonous substance was detected. They are distinguishable from most others by their pale yellowish-green color. There is a minor fraud of the pickle men which I have detected; and which I mention as a curious

trick. Most of that which is sold as pickled *red cabbage*, is the common cabbage, colored with some vegetable dye. There is nothing poisonous about it.

So far as I have examined the preserved meat, fish, and vegetables which are put up in this country, I have found no wilful adulteration or contamination. Different establishments seem to meet with different degrees of success in retaining and preserving the appearance and flavor of the articles which they prepare, but with that we have, in this connection, no concern. But this is not true of the same class of goods sent to this country from England. Anchovies, and many of the potted meats, are colored with *bole Armenian* and other filthy and injurious substances. But worse than all, the potted meats, so elegantly put up in jars, are often prepared from the flesh of horses and other animals which have died of accident or disease. Mr. Richardson, officer of the local Board of Health of Newton Heath, near Manchester, thus testified before a Parliamentary Committee:—

"We have in Newton five knackers' yards, and there is only one in Manchester. The reason is, that they have so much toleration in Newton; and it has been a source of great profit to them, because they have the means of selling the best portions of the horseflesh to mix with potted meats. I can say for a fact, that the tongues of horses particularly,

and the hind quarters, are sold for this purpose." It is only a short time since the English papers were full of accounts of vast quantities of such offal, supplied by contractors for the use of the British navy. Tons of it were examined, condemned, and ordered to be thrown overboard. Since these revelations have curtailed their business at home, considerable quantities of such articles have been shipped to this country. It is generally much more showily put up than that which is prepared here. I will not say that it is all of the character described above, but as there is no convenient way of discriminating between the good and bad, it is best not to meddle with any of it. If we are to be poisoned, let us at least die by the hands of our countrymen, and not by those of our hereditary enemies.

In treating of cocoa and chocolate, in a previous chapter, I spoke of the French samples as being uniformly good. This is equally true, so far as my investigations have gone, of all the alimentary substances imported from France. Their confectionery, liqueurs, preserved fruits, meats, etc., are all beautifully prepared and free from poisonous substances. In this they offer a striking contrast to the English, who exceed even our own dealers in the nefarious character of their tricks upon food.

An article brought from that country, and very extensively advertised here, has attracted my atten-

tion, and although it may not perhaps be properly considered among adulterated substances, yet the preposterous claims made for it as possessing the most wonderful virtues and surpassing excellence, induces me to notice it as a peculiarly fine specimen of English humbuggery in articles of food. The following extracts from Dr. Hassall's "Food and its Adulterations," will be sufficient to show John Bull's skill in selling a pennyworth for ninepence. The venality, too, of men of scientific pretensions, is well exposed, and Dr. Hassall's calm and well-considered remarks upon the subject, which will be found at the end of this chapter have, I am sorry to say, their application on this side of the water as well as the other. Too many of our men of science, occupying often brilliant and otherwise deservedly high positions, have, unhappily, lowered themselves and humbled their scientific brethren by attaching their names to "analyses" and "recommendations" which can, as used for their own profit by unscrupulous men, have no other effect than to assist in misleading, defrauding, and often injuring that public to which alone they must yet, in this country, owe all of distinction and advancement they may have attained, or may aspire to. This much may be said of those who have been thoughtlessly or unintentionally led into a seeming approval of fraud and quackery. To these, if such there are, who wilfully

prostitute a scientific reputation, to aid for hire the base purposes of trade, and especially to physicians who abdicate their proud position as the guardians and defenders of the public health, and degrade themselves to be the hirelings of its knavish enemies, no mercy should be accorded from the hands of the public they assist in defrauding. But to our purveyor of humble lentil-porridge, under the high-sounding name of

"DU BARRY'S REVALENTA ARABICA."

(*Copied from Circular.*)

DIRECTIONS FOR THE USE OF DU BARRY'S

HEALTH RESTORING FOOD

FOR INVALIDS AND INFANTS.

THE REVALENTA ARABICA,

Discovered, exclusively grown, and imported by

DU BARRY & CO., 127 *New Bond Street, London*,

sole owners of the Revalenta Estates, and of the Patent Machine by which *alone* the curative principles of the plant can be developed.

This light, delicious breakfast farina (without medicine of any kind, without inconvenience, and without expense, as it saves fifty times its cost in other more expensive remedies) speedily and permanently removes dyspepsia (indigestion), constipation, acidity, cramps, spasms, fits, heartburn, diarrhœa, nervousness, biliousness, affections of the liver and kidneys, flatulency, distention, palpitation of the heart, nervous head ache, deafness, noises in the head and ears, pains in almost every part of the body, chronic inflammation and ulceration of the stomach, eruptions on the skin, scrofula, consumption, dropsy, rheumatism, gout, nausea and vomiting during pregnancy, after eating, or at sea, low spirits, spleen,

general debility, paralysis, cough, asthma, inquietude, sleeplessness, involuntary blushing, tremors, dislike to society, unfitness for study, delusion, loss of memory, vertigo, blood to the head, exhaustion, melancholy, groundless fear, indecision, wretchedness, thoughts of self-destruction, etc. The best food for infants and invalids generally, and it is the only food which never turns acid on the weakest stomach, but imparts a healthy relish for lunch and dinner, and restores the faculty of digestion and nervous muscular energy to the most enfeebled.

DU BARRY & CO., 127 *New Bond-street, London.*

Analysis by the celebrated Professor of Chemistry and Analytical Chemist, ANDREW URE, M. D., F. R. S., etc.

"LONDON, 24 Bloomsbury Square, June 8, 1849.

"I hereby certify, that having examined Du Barry's Revalenta Arabica, I find it to be a pure vegetable farina, perfectly wholesome, easily digestible, likely to promote a healthy action of the stomach and bowels, and thereby to counteract dyspepsia, constipation and their nervous consequences.

"ANDREW URE, M. D., F. R. S., *Analytical Chemist.*"

PRICES OF THE REVALENTA* ARABICA FOOD IN THE UNITED KINGDOM.

		£	*s.*	*d.*
In London, canister at gross weight	1 lb.	0	2	9
" " " "	2 lbs.	0	4	6

*The word "Revalenta" pronounced by the Arabs and Bedouins "Reval-Yenta," may be translated "The Restorer," or "The Renovator." Its origin may be traced in the Sanscrit, where it corresponds to the Latin verb Revelescere sco. "Ex capitali morbo revalescere." OVID. "To recover from a deadly complaint." Philologists will find this note superfluous, but it may serve as an additional safeguard against trashy imitations, by which the unscrupulous are trying to impose upon the public under a variety of unmeaning names, such as Ervalenta, Relaventa, and all sorts of "ventas," the plain English of which would appear to be no other than that implied by a desire to raise the wind upon the unwary and illiterate.

		£	s.	d.
In London, canister at gross weight	5 lbs.	0	11	6
" " " "	12 lbs.	1	2	0
THE SUPER-REFINED QUALITY.				
In London, canister at gross weight	5 lbs.	1	2	0
" " " "	10 lbs.	1	13	0

Each canister is accompanied with full directions for use, and for the preservation of the "Revalenta" for years.

For consultations apply direct to Mr. Du Barry, stating minutely symptoms, origin, and date of ailment, age, occupation, habit of body and mind, mode of life, usual diet, past treatment, etc.

(*Certificate of* DR. URE *to a rival preparation.*)

"LONDON, 24 Bloomsbury Square, 2d December, 1847.

"I have analyzed a sample of 'Warton's Ervalenta,' and find it to be a pure vegetable product, very nutritious, and easily digestible, possessing the very valuable property of removing and counteracting habitual constipation, and of establishing a regularity in the alvine discharge. The said Ervalenta is, in my opinion, a perfectly wholesome dietetic.

"I have likewise analyzed an imitation of 'Warton's Ervalenta,' lately exposed and advertised for sale under the parodied but unmeaning title of 'Revalenta Arabica.' I find it not to be a pure vegetable meal, but to be disguised with colored powder, and to be mixed with a quantity of extraneous saline matter; additions which are most undesirable. The said 'Revalenta Arabica' is different therefore from the genuine ('Warton's') 'Ervalenta,' which is a pure vegetable product, of a much more agreeable taste, and lighter on the stomach than the imitation substance called 'Revalenta Arabica.'

"ANDREW URE, M. D., F. R. S.,

"Professor of Chemistry, and Analytical Chemist."

(*From another of Du Barry's Hand-bills.*)

"CRUEL DECEPTIONS ON INVALIDS EXPOSED. — The health

of many invalids having been fearfully impaired by spurious compounds of peas, beans, lentil, Indian, and oat meal, palmed off upon them under closely similar names, such as Ervalenta, Arabica Food, Lentil Powder, Patent Flour of Lentils, etc., and which are generally accompanied with a testimonial from Dr. Ure, or some unfortunate M. D. without name or practice. Messrs. Du Barry have taken the trouble of analyzing all these spurious imitations, and find them to be harmless as food to the healthy, but utterly devoid of all curative principles: and being of a flatulent and irritating tendency, they are no better adapted to cure disease than oil to quenching a conflagration. They would, indeed, play sad havoc with the delicate stomach of an invalid or infant; and for this reason the public cannot too carefully avoid these barefaced attempts at imposture. Moreover, whilst Du Barry's Revalenta Arabica has obtained fifty thousand testimonials of cures from parties of the highest respectability, these imitative imposters cannot show a single cure: nor is it likely they ever will; for the medicinal use of their compounds is calculated to produce no other but mischievous results. Dr. Ure errs considerably in the certificates he grants to lentil vendors. The Lentil is correctly described in Gray's Supplement to the *Pharmacopœia*, as follows, namely: '*Ervum Lens* (*Linn.*) *difficult of digestion, astringent, hurtful to the eyes: ordeal by Ervum Ervilla produces weakness of the extremities: horses fed upon it become almost paralyzed.*' In the *Gardener's Magazine of Botany*, we find it stated that the Lentil, notwithstanding its nutritious nature, is *difficult of digestion and sub-narcotic.*

"The characteristics of the Lentil we have invariably observed in countries where this flour is mostly used; thus, in France, where the Lentil is a very common dish among all classes, dyspepsia, constipation, flatus, nervous complaints, etc., flourish more generally than in any other part of the world.

"Barley flour, also, is difficult of digestion (see *The Lancet*, p. 420), and certainly devoid of curative properties. Nor have coloring and saline matters any thing to recommend them as curative agents. Yet nearly all the imitators of Du Barry's 'Revalenta Arabica Food' publish certificates with the name of Dr. Ure at the bottom, setting forth the wonderful superiority of those imitations, and asserting in one of them that the original Du Barry's 'Food' contains coloring and saline matters in another 'Lentil-flour' and 'Barley-flour,' in the next they will probably add a little prussic acid, or some other variation. But in order to expose the absurd, certificate vending system, we got this same Dr. Ure to analyze our Food, and after he had already sold several certificates to imitators, in which he declared it to contain saline and coloring matter, the result of his analysis was as follows (Here is inserted the certificate first given above). We believe this is the only correct certificate Dr. Ure ever wrote about our food."

So Du Barry and Company let the wind out of the great chemist's reputation: let us see Dr. Hassall puncture Du Barry's gilded balloon of humbug.

ANALYSIS OF DU BARRY & CO.'S REVALENTA ARABICA.

"*First sample.* — This article was found to consist of a mixture of *Egyptian* or *Arabian Lentil* and *barley meal.*

"*Second sample.* — This sample was found to consist, like the first, of a mixture of the *red* or *Arabian Lentil* and *barley flour*, sweetened with *sugar.*

"*Third sample.* — A third sample consisted of the *Arabian Lentil* and *barley flour*, with the addition of *saline matter*, principally *chloride of sodium* or common salt; it also possessed a peculiar taste, as though flavored with *celery-seed.*

"While Warton's Ervalenta is of a yellowish color, Du Barry's

Revalenta is of a pink or rosy hue: this arises from the different species of lentil employed, the German being yellow, and the Arabian lentil of a red color.

"The taste of the first of the three samples of Du Barry's Revalenta submitted to analysis, could scarcely be distinguished from that of pea-flour: that of the second sample was much more agreeable, owing to the quantity of sugar which it contained: while in the third sample the salt and peculiar flavor already referred to as resembling that of celery-seed could be distinctly recognized.

"Du Barry & Co., as appears from the circulars quoted, sell in canisters of not less than 5 lbs. each, price 22*s.* what they term a 'super-refined quality' of Revalenta. Having, as we conceive, too just an appreciation of the value of money, we have not possessed ourselves of a canister of this description of the article, and are therefore unable to give an analysis of it."

Dr. Hassall had previously analyzed a bottle of a syrup sold by Warton, Du Barry's rival, as *melasse*, and found it to be simply *molasses*. He says of a similar article offered by Du B. & Co.: "They also sell a syrup 'carefully packed in 7*s.* bottles,' and recommended to be employed in obstinate constipation. We preferred our money to the syrup, and therefore did not purchase any."

Thus it will be seen that this vaunted preparation, which is to cure, besides lesser ills, "fits," "consumption," "dropsy," "scrofula," "rheumatism," and "gout," to say nothing of "inquietude," "delusion," and "involuntary blushing," is nothing but a mixture of the Arabian lentil, the food of the degraded

and miserable fellahs of Egypt, with barley meal! This is what the delicate aristocracy of "Beacon-hill" and "Ward 11" buy at a dollar a pound, more or less. Verily, extremes meet, in this as well as in other things. It will be noted that Du Barry, in his onslaught upon Warton, Ure & Co., informs his customers that "lentils produce constipation, dyspepsia, and nervous complaints," the very diseases he offers his Revalenta, *made of lentils*, to cure. This is a fact worthy the attention of the homœopaths. Let them follow the track indicated; perhaps they will make a great discovery. They are welcome to the hint, and I promise them to claim no share of the honor or money they may win in its exploitation.

Dr. Hassall winds up the subject of the lentil speculation, as follows: —

"Lentils belong to the natural family of plants *Leguminosæ*, which includes the several kinds of beans and peas; they resemble to a very great extent, in color, structure, taste, and properties, the common pea; so great, indeed, is the similarity of organization, that it is difficult to discriminate between them, even by the aid of the microscope.

"Lentils, peas, beans, etc., all contain a considerable amount of nitrogenized matter, in the form of *Legumine*: when taken as an article of diet, they are found by most to be somewhat difficult of digestion, to occasion distension and flatulency, and to be slightly aperient. The properties and effects are so similar in the case of each, that it is almost impossible to draw any decided line of demarcation between them

"'Purified lentils' are prepared under a patent by Mr. Nevill,

who formerly supplied Du Barry & Co. with the article at £10 per ton; that is at about one penny and a fraction per pound.

"The object of the admixture of barley and other flours with lentil powder, is to diminish the strong flavor of the lentils, which is so disagreeable to many. Messrs. Du Barry & Co. still more effectually accomplish this object, in some cases, by the addition of sugar.

"As the cost of most of the prepared lentil powders — namely, 2*s.* 9*d.* per pound — forms a very serious obstacle to their use, supposing that in any respect it is desirable that they should be more generally consumed, we have framed the two following receipts, whereby a considerable saving of expense may be effected: —

FIRST RECEIPT.

Red or Arabian lentil flour	2 lbs.
Barley flour	1 lb.
Salt	3 oz.

Mix into a uniform powder.

SECOND RECEIPT.

Pea flour	2 lbs.
Indian corn flour	1 lb.
Salt	3 oz.

Mix as before.

"Being satisfied that lentils and peas do not differ in their properties to any great extent, we have devised the above receipt to meet those cases in which any difficulty may be met with in procuring the red lentil.

"As treacle (molasses) exerts a slightly aperient action when taken in considerable quantities, it may be used, if desired, with either of the ervalenta mixtures, the receipts for which we have given above; it has a great advantage over 'melasse' and 'purified syrup,' in price, costing only 4*d.* per pound.

"In the course of our observations we have had occasion to refer frequently to Du Barry & Co. The name of the person who represents Du Barry is Christian Klug, said to be a German Jew.

"A few observations on the subject of scientific testimonials will form not an inappropriate conclusion to this report.

"Science is never so important as when applied to the welfare and happiness of mankind, and it ought to be the object of every scientific professor to apply to the utmost of his power his own individual knowledge and experience to the benefit of his fellow-men. We regret to observe that this rule is not always acted upon, but a practice almost the reverse, and that there are many men so forgetful of the true objects of science, and of their own honor, as not to hesitate to give certificates, and lend the support of their names to all kinds of quackery and schemes calculated to impose upon the public.

"This practice indeed has of late become very notorious, and deserves the severest condemnation; for not only do the public suffer, but science itself is brought into contempt.

"No proposition is too gross or absurd, but that, by the aid of a few guineas, certificates bearing the names of apparently respectable authorities may be procured, whereby it may be palmed off upon the public.

"A manufacturer, wishing to bring before the world — under scientific recommendation — some article which he prepares, despatches samples of excellent quality to various professors and others, together with a fee, and the request to be furnished with testimonials; this request is, in general, readily complied with, and a certificate is drawn up in such terms as to inspire the public with confidence in the superior qualities and excellence of the article, whatever it may be. This course is radically and morally wrong; and we consider that certificates founded on the examination of a single sample emanating from interested parties, and capable from their wording of being applied to all subsequent samples of the same article, however inferior they may be, ought not in any case to be given."

CHAPTER VI.

ADULTERATION AND FABRICATION OF WINES AND LIQUORS. — STRYCHNINE IN BEER AND WHISKEY.

I APPROACH the subject of this chapter with considerable diffidence, because, while I am aware that there are many unjustifiable and even injurious frauds practised in wines and liquors, all my studies and investigations force me to the conclusion that the public very much overrate and misunderstand them. With this fact before me, I feel that my readers will anticipate revelations, in regard to secrets of the wine and liquor trade, of facts which have no real existence, and will consequently be disappointed and dissatisfied at what they may regard, in view of their preconceived opinions, as a "lame and impotent conclusion." But one advantage of an investigation of the character of that in which we are engaged, when entered upon with no other desire than the simple elucidation of the truth, is, that we not only learn what *are* the frauds against which it is necessary to guard, but also wherein dealers and manufacturers are unjustly accused. This is of

consequence in many ways. While the public are left in uncertainty upon such important matters, the sport of vague, unsubstantiated, and often contradictory and absurd rumors, and not the public alone, but the legislature, it is vain to expect any concentration of opinion, or any practical legislation which may afford security and protection. And when men in any particular trade see that they are charged, often on apparently scientific authority, with frauds of which they know their innocence, they are disposed to believe that all such charges, no matter against whom or by whom they are made, are equally baseless, and their remarks, and their influence in the community, whatever it may be, militate against every attempt at reforms which they might otherwise be disposed to assist.

The cause of the idea, so general, that large quantities of deadly drugs are constantly used by men engaged in the business of making and selling alcoholic liquors, is not difficult to understand. The people are fond of reading sensation paragraphs in the newspapers, and editors are equally fond of printing them. To be able to state that the learned professor Wash. Bottle of Porkopolis has discovered ten grains of strychnine in every bottle of whiskey upon which he has been able to lay his hands; that all the brandy in the country contains at least thirty per cent. of oil of vitriol; that all the wine is essence

of logwood, and all the champagne is sweetened with sugar of lead, — all these things make a sensation, and Professor Bottle is quoted as authority by temperance papers and temperance orators far and near. To be sure, people may wonder how such quantities of virulent poisons can be taken with such apparent impunity, and it is not surprising that suicides should sometimes happily defeat their purposes by an overdose, when their belief in the potency of strychnine and like substances has been so greatly impaired.

All such statements are as harmful and dishonest as the crimes they pretend to expose. There is no such enemy to a good cause, as a weak or unprincipled advocate. The moment people find he is dealing in falsehoods and seeking to draw upon their credulity, they properly close their ears to every thing he has to say, and too often turn their backs in distrust upon the cause he advocates. *Fiat justitia, ruat cælum;* do justice even to the spirit dealers, who have sins enough to answer for, even if they never sell any thing but what belongs legitimately to their trade. It has been a much bandied question with the physiologists, whether alcohol is a poison or a food; and, as is usually the case, both parties are partly right. While fermented drinks, tee-totallers to the contrary, are often useful, beneficial, sometimes almost indispensable to health, and as truly food as milk or soup, the same is correct only

in a very limited sense of distilled spirits, which are true chemicals, and as properly a poison as opium, or any other stimulant narcotic. It is true that when much diluted, and used in moderation, they approach nearer to the condition of fermented liquors, and may then be regarded as fulfilling some of the offices of nutrition, but any thing capable of producing, as a constant effect, such uniform and fatal lesions of important organs, as distilled alcohol, must, so long as the word retains its present meaning, be regarded as unquestionably a *poison*. Closet reformers and dreaming theorists, seeking — whether with selfish, benevolent, or, as most commonly, with mixed intent — to promulgate and enforce their plans for the correction and government of that humanity of which they are practically ignorant, will always work with square and rule. If the child's leg is not exactly straight they must break it to make it so; for is not the right line their ideal, and can a man walk on a leg that deviates by half an inch from rectilinearity? So reasons not the practical well-wisher to the race. He knows that very good progress can be made on a crooked leg, which is at any rate better than a broken one, and he knows too the proverb "the shortest cut is not always the nearest road," and acts accordingly. Temperance reformers will come to that one of these days, and will begin, at least, by trying to substitute

the less for the more injurious stimulants. If, afterwards, they can abrogate what seems, at least, to be a natural law, and prevent men from wanting any artificial stimulation, they will, perhaps, do a good work.

But a good deal of this is digression, for which I hope the reader will pardon me, even if he dissents. I trust no one will regard me as an enemy either to the cause of temperance or to its noble advocates, because I entertain somewhat different and less hopeful views than many, upon the practicability of plans which seem to have had a fair trial and to have failed.

Having premised that my revelations in regard to the subject in hand will not be of so startling a nature as some may anticipate, for in fact the frauds of the spice grinders, the confectioners, the picklemen, and even the bakers, are more pernicious in their action upon the health, than those of the liquor men, I will proceed to show what are the most common rascalities practised in the business, and how far they are likely to prove injurious to the health of consumers. It is well to note that into this last point there enters an element which we have not had to encounter before; that is, the injurious effects of the adulterated substance itself. While alum in bread, or lead or copper in pickles and confectionery, when once suspected, may be

traced by their effects without the complications arising from any specific action of the articles which they contaminate, we have, in the case of ardent spirits, a potent disturbing agent, capable in itself of producing a great number of abnormal symptoms, likely to disguise or mask those which might arise from harmful adulterants. Doubtless many cases of sickness charged to "rifle whiskey" had a quite sufficient cause in the alcohol alone.

There is no doubt that formerly, very much more pernicious substances were employed in the fabrication and adulteration of liquors than now. The chemical skill that enables us to detect many adulterating ingredients, has come equally to the aid of the persons who employ them, and many old and barbarous receipts, used in the trade, whereby it was only possible to make coarse and imperfect imitations, have been abandoned for the delicate and really scientific formulas which chemists have devised, and into which, as one of them informs us in the preface to a treatise * upon the subject, "no material enters not found by chemical analysis to exist in the original spirit we seek to imitate." "If," he concludes, "we can introduce the adoption of a system of manufacturing that is free from the objections now existing,

* "The Bordeaux Wine and Liquor Dealers' Guide." New York, published by Dick & Fitzgerald, 1858.

that is, the free use of poisonous compounds, we shall have accomplished some good, and the object we sought in giving to the public the results of years of experience and close study." It will be noticed that this gentleman, with true French *naiveté*, claims to be a philanthropist, and perhaps with as much reason as some others whose claims would be more likely to be admitted. "If people will drink more *vin de champagne*, and more pure French brandy than the vineyards can produce, it is at least an advantage that the article with which they are supplied to make up the deficiency, should be no more injurious than the genuine.

The basis of most of the fabricated wines, is either some cheap wine, as Bordeaux or Rhenish, or, more commonly, cider. This is prepared by fining, clarifying, and repeated racking off, until it presents a suitably clear and bright appearance; it is then subjected to the proper processes of admixture and flavoring. But cider itself is often imitated, and replaced by an entirely artificial substitute. There are many formulas for this "imitation cider." The following is from "Lacour on the Manufacture of Liquors." M. Lacour, it will be seen, unlike the author before quoted, does not repudiate the use of injurious substances in his business.

Sweet Cider — Imitation. — Water, 100 gallons; honey, 5 gal-

lons; catechu, powdered, 3 ounces; alum, 5 ounces; one quart of yeast; ferment for 15 days in a warm position in the sun; then bitter almonds, half a pound; burnt sugar, one quart; 3 gallons whiskey; if acid predominates, correct by addition of honey; if too sweet, add sulphuric acid to suit taste.

Another recipe, by the "Bordeaux Guide" is, in accordance with his avowed principles, harmless.

To 8 galls. soft water,
8 lbs. N. O. sugar,
7 oz. tartaric acid,
1 qt. yeast.

Put the ingredients into a cask and stir it up; after standing 24 hours with the bung out, bung it up close, add 1 gall. spirits, and let it stand 48 hours, after which time it is ready for use.

These, as well as genuine cider, are used as the basis for factitious wines. Many of the adulterations to which wine is subject are very difficult, and some of them impossible to discover; such as the admixture of cheap with a better quality of wine, which, though they may vary greatly from each other in looks and flavor, may differ but little in their chemical constituents. These last, too, have no fixed standard; the wine of the same vineyard varies, year by year. Wine is a very complex substance, and its analysis is attended with many difficulties, particularly as regards its constituents in their organic forms; and here, too, the microscope

fails to afford us the aid which it gives so satisfactorily in many other researches. Still, a great many of the adulterations of wine may be detected, and it is fortunate that those most injurious to health are among the number.

One of the most dangerous adulterations of wine is *lead*, generally in the form of an acetate (sugar of lead). This may be accidentally present, in consequence of shot having been employed in cleansing the bottles, and one or two left behind, adhering to the glass; but it is frequently added for the purpose of preventing wine from turning sour.

Dr. Watson (Chemical Essays) states that the practice of adding lead to wine was at one time common in Paris, and many instances are to be found in the books, where people have been made ill by drinking wine adulterated with lead. All the symptoms and consequences narrated in a previous chapter, as characteristic of lead poisoning, even to paralysis and death, are recorded. At present, the activity of the police in enforcing the enlightened sanitary regulations which have been devised by the French government, has, we are informed, entirely put down this gross abuse. The objects formerly sought in the use of lead: arresting the progress of acetous fermentation, and rendering white wines, when muddy, transparent; are, by the aid of science, much better performed by other and harmless

agents, and it is quite uncommon, I believe, for chemists to find more than occasionally a trace of lead, in samples of wine.

All the different wines, from champagne to port, are imitated with varying success, and it is probably true that very little pure, unmixed, unadulterated wine is to be purchased in this country. This is particularly the case with regard to the stronger wines, port, Madeira, and sherry. The German wines are not popular in this country, not in demand, and are consequently not so subject to adulteration. All imitations, too, of light wines are very imperfect and liable to spoil. Claret comes to us in considerable quantities not much adulterated. The cheaper qualities are mixed with cider, colored with cochineal or logwood. Burgundy, which may be classed with claret, is tolerably pure, though usually brandied. Genuine champagne can be bought, without difficulty, in all the large cities, by those who choose to pay its price, but great quantities of what is sold as champagne, are fabricated in this country. I have examined many samples of this character, but have never detected any injurious substance in them. The following two very common formulas will exhibit their ingredients: —

Champagne. — To 40 galls. "prepared cider" add: 3 lbs. loaf sugar, 2 ounces crystallized tartaric acid, 1-4 quart yeast,

3 galls. water and 4 galls. spirits, 15 under proof. Let it stand 10 days, fine and bottle it, if sparkling. If not sparkling, again fine it, and add more acid, and this process should be repeated until it is suitable for bottling. When bottled, put into each bottle a piece of white sugar the size of a pea, then cork and wire the bottle, covering with tin foil, after the manner of champagne.

Champagne. — Cider, sixty gallons; clear spirit, three gallons; honey, two gallons and a half; boil and ferment; fine with milk.

It will be seen that in these, as in most artificial wines, cider is the chief constituent, and this probably accounts for the fact that they are much more apt to give rise to headaches, an almost universal effect of cider, when drank in considerable quantities.

The following receipts for making factitious port and sherry, from Lacour's book, contain most objectionable ingredients.

Port Wine. — Cheap cider or claret, twenty gallons; honey, two gallons; carbonate of soda, twelve ounces; strong tincture grains of paradise, one and a half gallons; powdered catechu, five ounces; color with a strong tincture of logwood, and a small portion of burnt sugar. The reader observes that this wine is made without the addition of any spirit, though a small portion would greatly improve it. The object of the carbonate of soda is to neutralize a portion of acid in the wine or cider, which if allowed to remain, would present too large a proportion of acid for good port.

Sherry. — Cider, ten gallons; bitter almonds, four ounces; honey, one gallon; mustard, four ounces. Boil for thirty minutes

and strain, then add spirit of orris root one half pint; essence of cassia, two ounces; and rum three quarts. Jamaica is preferable, as this wine, when made from this formula, is often prepared for the *auctions*. The amount of neutral spirit added, becomes an important item, owing to the cost. When this is kept in view, the tincture of grains of paradise should be substituted for spirit.

These infamous preparations would possess none of the properties which make genuine wine desirable, and, in cases of sickness, often essential to the recovery of the patient. On the value of wine Liebig has the following remarks: —

As a restorative or means of refreshment, where the powers of life are exhausted; of giving animation and energy when man has to struggle with days of sorrow; as a means of correction and compensation where misproportion exists in nutrition, and the organism is deranged in its operations; and as a means of protection against transient organic disturbances, wine is surpassed by no product of nature or of art.

The nobler wines of the Rhine, and many of those of Bordeaux, are distinguished above all others by producing a minimum of injurious after-effect. The quantity of wine consumed on the Rhine by persons of all ages, without perceptible injury to their mental and bodily health, is hardly credible. Gout and calculous diseases are nowhere more rare than in the district of the Rhinegau so highly favored by nature. In no part of Germany do the apothecaries' establishments bring so low a price as in the rich cities on the Rhine, for there wine is the universal medicine for the healthy as well as the sick; it is considered as milk for the aged.

When we consider that this beneficent gift of nature may be, and doubtless is, often replaced in this country by such concoctions as those the formulæ for which are given above, it is not wonderful that they should not only fulfil none of the requirements of the case, but actually produce most baneful, and even, in persons feeble or ill, fatal effects. The "grains of paradise" of which a strong tincture is ordered as a cheap substitute for spirit, are what is known as Guinea or Melegueta pepper, of which Drs. Wood and Bache (U. S. Dispensatory) inform us that "their effects on the system are analogous to those of pepper; but they are seldom used except in veterinary practice, and to give artificial strength to spirits, wine, beer, and vinegar." Imagine the effects upon a delicate stomach of a substance like this, taken under the supposition that it was a wholesome, nourishing, and strengthening draught, such as the great chemist describes wine to be!

The free importation of the cheap and wholesome wines of Germany and France, and the extension of the grape-culture in the United States, will do more to wean our people from the fiery alcoholic potations which too often destroy both body and soul, than any other method that can be devised. The promotion of such an end is well worthy the exertions of all instructed and practical friends of temperance.

The consumption of malt liquors is extending greatly in this country, and this is having a powerful effect in circumscribing the use of ardent spirits. Used in proper moderation, they are unobjectionable and often beneficial, and they have the advantage of being rarely adulterated with any thing injurious to health. It is charged against brewers, that they sometimes use other bitters, as quassia, gentian, or even aloes, in place of hops; but, so far as I can learn, this is very rarely done. None of these substances can replace hops as a *preservative*, to prevent deterioration and souring of malt liquors, and that was originally the sole, and is now the chief object of their employment. It is interesting to recall the fact that hops were originally regarded as themselves an adulteration, and their use forbidden under heavy penalties. The bitter taste which they imparted was also an obstacle in the way of their introduction, but the fact that hopped ale and beer kept better, was sufficient to secure their final adoption. The public taste soon adapted itself to their flavor, and would now probably object more to the absence than our ancestors did to the presence of hops in this beverage.

It was originally in regard to beer that the story of the employment of strychnine in the manufacture of liquors was set afloat. To give a clear idea of the whole matter, I extract the account given in Dr.

Hassall's work; followed by the statement upon the same subject of the eminent chemist of this city, Dr. A. A. Hayes, State Assayer; a gentleman whose well-known integrity and high professional character are everywhere a sufficient guarantee for the correctness of his assertions. It seems that all this ought to be enough to put at rest this absurd story, which one can hardly take up a newspaper without seeing repeated, either directly or by implication, as an admitted fact.

"The alleged adulteration of ale (says Dr. Hassall) with which our attention has been more particularly occupied, is that by *strychnine*. The following are the circumstances which induced the editor of 'The Lancet,' Mr. Wakley, to undertake, through the author, a very extensive and vigorous inquiry into the subject.

"In the year 1850 a Report came before the public, in which it was asserted that the deadly poison, strychnine, is commonly employed by brewers in the manufacture of 'bitter beer' or 'pale ale.'

"The following was the origin and foundation of this Report:—

"In the course of a lecture delivered at the 'Conservatoire des Arts et Metiers,' M. Payen is asserted to have stated that strychnine was prepared in large quantities in Paris, and that the French authorities had ascertained that it was destined for England, it being employed in the manufacture of the celebrated bitter beer of that country.

"This statement, after having appeared in some of the French papers, and amongst others, in the 'Constitutionel,' attracted the attention of some English journalist, who commented at some length upon it, incautiously treating the assertion as though its

truth had been fully ascertained. At length the injurious statement made its way into the columns of 'The Times' newspaper, and thus became universally disseminated.

"It was impossible for the brewers of bitter beer, the preparation of which is confined to a small number of persons, to pass by without notice so grave a charge, and one so immediately affecting their interests. Accordingly the two chief firms, those of Messrs. Allsopp and Sons, and Messrs. Bass and Co., lost no time in publicly denying, in the most unequivocal terms, that strychnine, or any other deleterious substance, was ever employed by them in the manufacture of their beer.

"These celebrated brewers suggested that their bitter beer should be subjected to a searching chemical and microscopical examination, and expressed their willingness to place the inquiry in the hands of 'the Analytical Sanitary Commission.' They offered to throw open their breweries, stores, etc., in the most complete and unreserved manner, and afford every facility for the fullest investigation.

"Feeling that the subject was one of great importance; that it involved the public health to a great degree, and also the pecuniary interests of a trade, which, from its magnitude, had almost assumed a national character; that it also affected the judgment of the medical profession by whom the bitter beers had been so strongly recommended — Mr. Wakley ultimately agreed to undertake the inquiry upon the distinctly declared condition that the results of the investigation and analysis, whether favorable or unfavorable to the reputation and quality of the beer, should be unreservedly and faithfully communicated to the public.

"The importance of the subject will be duly appreciated when it is recollected that strychnia is the active principle of *nux vomica*, that it is remarkable for its intense bitterness and highly poisonous nature; one sixth of a grain having been known to prove fatal.

"In order to put the statement to the test, forty samples of bitter beer were subjected to analysis, twenty of the ale of *Messrs. Bass and Co.*, and the like number of samples of the ale of *Messrs. Allsopp and Sons.*

"They were all found to consist of the products of *malt* and *hops*, and the constituents of *pure spring water*: no other ingredient of any kind being discovered, either organic or inorganic.

"These samples were procured under circumstances which preclude the possibility of error, fallacy, or of preparation for the selection.

"Many of the samples were taken from the stores of Messrs. Allsopp and Sons, and of Messrs. Bass and Co., at Blackwall and in the city, while others were procured from the principal agents and bottlers in the metropolis. In all cases, the utmost facility for investigation was afforded.

"Some of them also were destined for exportation, others for the home trade; while the dates at which they were brewed extended over a period of nearly two years. Not any sample of beer analyzed was brewed *after* the promulgation of the statement concerning the employment of strychnia.

"The stores at Blackwall belonging to Messrs. Bass and Co., and Messrs. Allsopp and Sons, each comprise many thousand butts, hogsheads, and barrels of bitter beer, which, arranged in tiers, and piled one above the other, extend over a space of several acres. The whole of these stores were thrown open to us, and liberty given to tap whichever cask we chose to select. In the case of the agents and bottlers the same liberty of choice was permitted, and in this manner butt after butt was opened and samples taken.

"It should be observed that the casks are all branded with the names of the brewers, and that in most cases a register is kept, not only at the breweries and stores, but also at the agents and bottlers, of the dates at which the different lots were brewed, all

chance of mistake in the selection of the samples being thus obviated by reference to the marks and registries.

"Under the above circumstances, and after the most scrutinizing examination, microscopical, chemical, and physiological, we have failed to detect the smallest atom of strychnia, or, indeed, of any other ingredients than the products of malt and hops, and the constituents of pure spring water.

"Unknown to, and wholly independent of ourselves, Messrs. Graham and Hoffman, at the request of Messrs. Allsopp and Sons, subjected several samples of their bitter beer to analysis. In their published report, it is stated that they failed to discover the slightest trace of strychnia.

"Those gentlemen likewise placed themselves in communication with M. Payen, with whom the report was stated to have originated, in order to ascertain from himself the exact nature of the statement advanced by him.

"It appears that the charge made by M. Payen was founded on information obtained by M. Pelletier, the celebrated preparer of quinia and other alkaloids, in France, who at one time received an order for a large quantity of strychnia, the destination of which was at first unknown to him, but which he afterwards found was exported to England, and used, so he informed M. Payen, to complete the bitterness of certain kinds of beer.

"'We have reason to know,' write Messrs. Graham and Hoffman, 'although it is not stated by M. Payen, that these remarks of Pelletier refer to a period of ten or twelve years past; and further, although not informed of the amount of the order, we have good authority to state that fifty or one hundred ounces would have been considered a large order for strychnia at that time. The calculation already given, shows how utterly insignificant such a supply of strychnia would be for its imagined application in the pale ale breweries. It is likewise known that the manufacture of strychnia has not been on the increase in France of late years.'

"Finally M. Payen expressed his regret that he had ever said the fraud *appeared* to have been practised, although, at the same time, he accompanied this observation with the further remark that *the falsification had no doubt ceased.*

"M. Payen excused the statement made by him on the ground that he did not originate it, and that the charge had been made public in the year 1850, in a French work treating of the Adulterations and Falsifications of Food. We have procured the publication in question, and find that it refers to the matter rather as a vague and uncertain report, than as a distinct allegation of the use of strychnia by English brewers: the author concluding his remarks on the subject in the following words: 'We hasten to say that this sophistication, like the preceding, is far from being based upon ascertained facts."

Dr. Hassall concludes as follows: —

"From all these considerations, therefore, we conclude that the statement made concerning the use of strychnia in beer, under any circumstances, is scarcely consistent with probability."

The result of Dr. Hayes' investigations as to the existence of strychnine in whiskey, were made public in the Boston papers a short time since. The following I extract from the *Boston Courier*: —

"On Poisons in Alcoholic Spirits. — It has been a popular notion that poisonous bodies, especially strychnine, are added by manufacturers of distilled spirits, as a matter of economy, of course, and to give a greatly inferior article the appearance of a good article. Temperance lecturers have made a great deal on this point, and have dwelt much upon it, launching some of their

sharpest arrows against it. If it were true, they were surely in the right, and were doing good service to the community in exposing so hideous a practice. But if science, examining with its clear and serene eye, declares that the practice does not exist, then truth and the cause of temperance can gain nothing by persisting in propagating an error. Dr. A. A. Hayes has had his attention drawn to the subject, and he declares that, from a somewhat extended analytical observation on spirits produced from grain in this country, he can find no good reason for the statement that poisonous bodies, 'especially strychnine,' exist in them. And this conclusion, he is careful to remark, has been supported by the testimony of those who are opposed to the manufacture, but who frankly admit that no case has ever fallen under their notice at the places of manufacture, which would lead to even an inference in regard to the adding of any deleterious body to the distilled spirits. Dr. Hayes explains that the addition of non-volatile bodies to the fermented worts, if made, would not contaminate the spirits distilled from them: and it is probable that the supposition in relation to the use of strychnine for the purpose of increasing the product of whiskey arose from the *ruse* of a foreman, who wished to conceal the particular characteristics of his ferments in daily use.

"Prof. Hayes has examined this subject very closely, and he states with the candor of conviction, that the spirits produced in this country to serve as beverages are remarkable, as a general thing, for their purity and freedom from any substances which careful rectification can remove. He goes further, and says: 'When, through age and suitable exposure, the oils contained in them have passed into ethereal bodies, and thus ripened the spirits, they become equal in soundness and purity to any products imported from abroad, and far less deleterious than most of the so-called brandies of the present time.'"

No chemist, or scientific man of any reputation, has ever stated that he has succeeded in detecting strychnine, either in beer or whiskey; on the contrary every one whose attention has been directed to the subject has declared that, so far as their researches extend, there exists not the slightest foundation for a report, which has nevertheless gained such extensive circulation and belief.

With regard to distilled spirits generally, the common opinion in reference to their sophistication and "extension," is true, and especially so in the case of brandy and whiskey.

Large quantities of whiskey exported from this country to France, return into our ports, mixed with the brandy which is nevertheless supposed to be pure, because brought directly from the country where it is distilled. Besides American whiskey, much of the vile beet-root and potato-spirit of Europe is used for the same purpose. How much of this adulterated brandy is imported it is difficult to estimate, but I have the authority of men engaged in the business, as importers, for stating that it is very large, and it has even been set by some of them as high as sixty per cent. of the whole importation.

But probably seven eighths of all the brandy sold in the United States is not even "pure as imported." Various substances are used in its adulteration, and

perhaps it is safe to say that the greater portion does not contain a drop of the grape spirit to which alone the name of "brandy" properly belongs.

The most common adulteration consists in the addition of more or less of what is known as "neutral spirits," which is merely weak alcohol, made by passing whiskey through a "rectifying apparatus," or charcoal filter, which deprives it of most of its flavoring ingredients, leaving it nearly tasteless. Sometimes only a few gallons of spirit are added, sometimes it constitutes a half or three quarters of the mixture, and sometimes, as said before, no grape spirit whatever is employed.

When the admixture of neutral spirit is great, or where it is used alone, some flavoring substances must be added, capable of giving a taste which will resemble that of brandy. The preparation also requires to be colored, and the casks which contain it must have an old, and foreign appearance, and bear certain marks supposed to be peculiar to those which have passed the custom-house.

The flavoring substances which contribute to give its distinctive taste to brandy are sugar, volatile oil, acetic acid, acetic ether, œnanthic ether, and tannic acid or tannin. These substances, or others resembling them are therefore necessary to be added to the tasteless spirit, in order to make it pass for "Cognac," "Otard," or "Hennessy," with the skil-

ful judges of those articles who abound in our country, and who, under their invigorating influences, are enabled to contribute so much to the purity, efficiency, and stability of our political institutions.

The *volatile oil* is produced in excess during the distillation of brandy, only a portion of it being dissolved by the spirit. It is imported into this country under the name of "*Oil of Cognac*," and possesses a strong, pungent, and disagreeable taste and odor. On it, chiefly, depends the flavor of brandy.

Acetic acid is pure, concentrated vinegar: *acetic ether* is a combination of acetic acid with alcohol; it has a pleasant, diffusive, and somewhat fruity smell, and a cooling, agreeable taste. Nitrous ether, or "sweet spirits of nitre," is often used in flavoring spirits as a substitute for acetic ether.

Œnanthic Ether is an oily, fragrant, and volatile liquid. From it brandy derives most of its peculiar odor. This, like the cognac oil, is imported from the wine-making countries specially for use in preparing artificial brandies.

Tannic Acid or *Tannin*, is the vegetable astringent principle, existing chiefly in the bark, seeds, and wood, and sometimes in the sap and fruit of vegetables. In genuine brandy it is principally derived from the seeds and skins of the grape, and from the wood of the casks in which it is kept.

The following formula for an artificial brandy will show how these articles are employed.

Cognac Brandy. — To forty gallons pure spirits, add two to three ounces oil cognac (dissolved in alcohol), one and a half pounds loaf sugar, two ounces œnanthic ether, two ounces acetic acid, and two ounces tincture of kino. To this add from five to ten gallons of the brandy to be imitated. Let it stand about eight or ten days. Color it with burnt sugar, using a sample of the kind to be imitated as a guide. If you desire a higher flavored brandy, use more of the cognac oil; if a higher odor, more œnanthic ether: if softer and richer, more sugar; if stronger, increase the proof of the spirit by adding strong alcohol.

The *kino* here ordered, like the *catechu* mentioned in one of the receipts for wine, is a vegetable extract containing a large proportion (over seventy per cent.) of tannic acid. It is a pure and simple astringent, and cannot be regarded as possessing deleterious properties which would make it an objectionable substitute for pure tannin, to which it is preferred on account of cheapness.

If all the imitation brandies were prepared on this plan of adding nothing to the pure spirit but substances as nearly identical as possible with those existing in genuine brandy, whatever might be said of the dishonesty of the transaction, we could not charge that any poisonous results would follow the use of one in preference to the other; but unfortunately many are not satisfied with the profits to be

gained in this way. The following is a receipt for what the good M. Lacour calls

"*New York Brandy.* — Filtered whiskey, twenty gallons; clear water, seventeen gallons; tincture of Guinea pepper, one and a half gallons; tincture of pellitory, one pint; strong tea, one gallon. Color with burnt sugar and red sanders, and add four ounces of nitric ether and half a gallon tincture of prunes."

This is a "poor man's brandy," and doubtless the laboring man finds it very warming and comforting. The Guinea pepper I have already spoken of as used to give a smartness and fictitious strength in the mouth. Whether pepper is really more hurtful taken in "filtered whiskey" than on beef-steak, I cannot say, but should advise the reader to decline drinking any of M. Lacour's preparation, unless, as in the south, there was no other alternative except to fight. Pellitory is an acrid root, coming from the Mediterranean. It produces when swallowed, a violent burning sensation in the mouth and throat, and is employed for the same purpose as the Guinea pepper. Pellitory is sometimes used by dentists as a local application to carious teeth, with a view to its benumbing effect, before plugging. Strong tea is used as a substitute for kino, to yield the necessary tannin to give astringency.

Within the last few years, particularly since the partial failure of the grape crop in Europe has

caused an advance in the price of brandy, the use of American whiskey has become greatly extended. The kind most in repute is that distilled from a mixture of corn, rye, barley, and sometimes wheat, in the western States, and particularly in the State of Kentucky. It is known as Bourbon whiskey, from the county of Bourbon, one of the oldest counties of Kentucky, where formerly considerable quantities of whiskey were made. This county has of late become almost exclusively a grazing country, the farmers having abandoned to a great extent the raising of grain crops, and devoted their attention to cattle, horses, and mules. Consequently but little whiskey is now made within its limits. The name by which the better kinds of whiskey are now known in the West is "copper whiskey" or "copper-distilled." This variety is almost exclusively the product of private distillation, carried on by the farmers on a small scale in copper stills holding not more than two or three barrels. The grain is carefully malted and prepared, and all the processes are of a kind calculated to give a pure and well-flavored spirit. The ordinary whiskey of the country, made in large distilleries, in immense iron stills, and with unmalted corn alone, is commonly known as "prison whiskey," from being made in large quantities at the Ohio State prison; or "rifle-whiskey" and "rot-gut" from the popular opinion of its potency.

This common whiskey before being sold, usually passes into the hands of the liquor-merchants, who *rectify* it, that is, they pass it through immense charcoal filters, which deprive it of a large proportion of its grain oil or fusil oil, one of the products of this distillation, especially when pressed, as it is in the large distilleries, so far as to extract all of the alcohol which the wort contains. Unless this were done, the rank taste and odor which the fusil oil gives to the whiskey would render it almost unsalable. If this were all that was done to the whiskey, the rectifiers might be regarded in the light of public benefactors, for the fusil oil is, in the large proportion in which it exists in cheap whiskey, unquestionably deleterious; but there is reason to believe that these manipulators increase their profits by adding large quantities of water to the whiskey, and maintain the appearance of strength, by adding pepper, pellitory, and other substances of a like nature. It has been frequently asserted that sulphuric acid (oil of vitriol) and nitric acid (aqua fortis) were also used for the purpose of giving a fictitious strength, but any one who knows any thing of the nature of these acids is aware that they would have no such action, nor indeed any effect except to give the whiskey a sour taste which would be instantly detected. A mixture of sulphuric acid and olive oil is sometimes added in the proportion of a few drops to a barrel,

to give liquor what is known as "a bead." This bead consists of a number of small bubbles which float upon the surface of any liquor after it has been shaken, and it is supposed to be a test of strength; if the bubbles disappear quickly, it is regarded as indicating a low proof. The addition of the mixture of acid and oil gives to weak spirit the property of "holding its bead." This, and neutralizing excessive sweetness in artificial wines, are the only purposes for which oil of vitriol is employed by liquor dealers. Nitric acid is not used at all.

Now perhaps the reader will not be surprised to learn, that probably not one tenth of one per cent. of all the whiskey drank is made in "old Bourbon;" and not over two per cent. is farmers' or copper distilled whiskey, which is about the same thing as that formerly made in Bourbon county. The author has resided for many years in the State of Kentucky, and has had the best opportunities of ascertaining the facts, and he states with confidence that seven eighths of what is sold in the Atlantic cities as Bourbon whiskey is entirely or in great part factitious, — most of it is simply the common rectified whiskey colored and slightly flavored. This is known in the liquor markets of Louisville and Cincinnati as "Patent Bourbon," and forms the principal part of the exportation eastward. I have personal knowledge that an individual — now de-

ceased — who was until his death one of the largest importers into Boston of Kentucky whiskey, purchased in Louisville at least five barrels of "Patent Bourbon" for one of "copper distilled," and yet the fact that the whiskey was bought of this man, has often been adduced to me as evidence of its genuine character. To give a little idea of the difficulty of getting the best whiskey, even in Kentucky, I will state that during last winter I knew of an individual paying a farmer in Spencer county, Kentucky, three dollars a gallon for copper whiskey, seven years old; and probably not one hundred barrels of farmers' whiskey, even three years old, could be bought in that State. New copper whiskey can be had, genuine, of the farmers, at about seventy-five cents a gallon, but it is usually all bought up by the dealers as soon as made, and when it is once in their hands, there is little prospect of getting any of it in an "unextended" condition.

It is probable, however, that most of what is sold as Bourbon whiskey is free from the worst adulterations, such as Guinea pepper, etc., and that so far as any injurious effect upon health is concerned, there would be little to choose between the factitious and the genuine. The chief objection is that the purchaser pays three or four prices for the *name*, for the "Patent Bourbon" can usually be bought in Louisville at twenty-five cents a gallon, while

in the eastern cities the price ranges among the dollars.

Dr. Hayes has called public attention to an accidental contamination of copper whiskey of grave importance to the community. I extract his remarks upon the subject from the article already quoted: —

"There is, however, a source of danger, which, so far as he can learn, has been overlooked, or possibly attributed to criminal intention. This remark applies as well to the newly distilled and, in most cases, to the older spirits; and he regards a knowledge of the fact as of especial interest to the medical profession. It is this: Newly distilled spirits, of the most common kind, often contain *salts of copper*, *of lead*, or *tin*, derived from the condensers in which the vapors are reduced to a fluid form. The quantity of copper salt contained in the bulk usually taken as a draught, is sufficient to produce the minor effects of metallic poisoning; the cumulative character of these poisons may even lead to fatal consequences. With a knowledge of this fact, instead of resting on a supposition of the existence of an organic poison in the spirits which have caused the sickness, the physician may notice the symptoms of metallic poisoning, in persons addicted to the habit of using newly distilled spirits, and interpose his aid in preventing the fatal termination of vicious indulgences. Old, or more matured spirits, have generally lost every particle of the salts once held in solution. Changes in the organic solvent have caused the deposition of the metallic compound. In order, therefore, to avoid the poisoning effects of these salts, perfectly well-ripened and *clear* spirits only should be used in the preparation of medicines; for, while the clear, transparent fluid contains no metallic impregnation, a turbid, though ripened spirit, may prove deleterious through its *suspended* metallic compounds."

It is to be hoped that proper precautions will be taken hereafter, on the part of manufacturers, to prevent the occurrence of these dangerous accidents; otherwise the character of Kentucky whiskey will be apt to suffer even more than from the sophistications to which it is subject.

I am sorry to say that for most of the impurities in wines and liquors there are no tests sufficiently simple to be available for ordinary use. One of them, however, the vile adulteration with pepper and other pungent substances, may be easily detected. All that is necessary is to evaporate a portion of the suspected liquid in a suitable vessel over a spirit lamp. The residue which remains after the evaporation of the liquid portion, will, if it contains such substances, manifest it plainly to the taste.

CHAPTER VII.

MILK. — ITS PHYSIOLOGY. — ITS CHEMISTRY. — ITS NATURAL DEPRAVATIONS. — ITS ARTIFICIAL ADULTERATIONS AND CONTAMINATIONS. — TESTS OF PURE MILK. — LACTOMETER AND GALACTOMETER.

MILK is an animal secretion, provided for the support of the young animal during the first months of its existence. Those animals which possess this power of secreting milk are united by naturalists into a single class, the *mammalia*, and the function is, with rare exceptions, confined to the females of this class. Both sexes, however, possess the organs by which milk is secreted, and undoubted instances are cited in which they have received a development in the male sex which enabled the individual to furnish this secretion in considerable quantities. In fact, as this function is, even with females, almost universally a temporary one, connected with the other function of gestation, it is almost as rare to find it exercised by the female under any other circumstances, as by the male. Those who are curious in regard to this interesting matter, I would refer to the various works on physiology, where

instances are given both of males and childless females in whom this function has been developed.

Domestication has the effect upon some animals of prolonging the period of lactation; not so much, indeed, domestication, in the general sense, as the pursuit of the special purpose of that domestication which is the production of milk continuously, or for a long time. In this there is in fact no variation from the natural law expressed in the old maxim *Ubi irritatio ibi affluxus* (where there is irritation thither is a flow), for as the natural irritation produced by the sucking of the young animal maintains the constant flow of the secretion which would otherwise soon cease, so the continuance of this irritation by artificial means will continue the secretion for a much longer time; indeed, it is now held by some cattle breeders and dairy-men, that the only natural limit to this sustained flow of milk is a renewal of the gestative function, and that they can maintain the secretion of milk in their cows indefinitely by simply spaying them. A very familiar instance of the increase of a secretion from irritation is presented in the augmentation of the salivary secretion by the use of tobacco.

The animals which are chiefly relied on to supply mankind with milk are the cow and the goat. But the mare, the ass, the buffalo, the reindeer, the camel, the sheep, and occasionally other animals have been

resorted to for the same purpose. With but few and slight exceptions, the cow alone supplies the people of the United States with this necessary article, and my remarks will consequently be limited to that variety, although there is no great or essential difference between the milk of the different animals I have named.

Milk is secreted from the blood by an organ or set of organs known as the mammary or lactiferous glands. In the ducts of these glands the milk is retained until they become so distended as to be able to hold no more, when, especially in the cow, they may often be seen emptying themselves spontaneously. When freshly drawn, the milk of the cow is uniform and homogeneous. Under the microscope it is seen to consist of a somewhat turbid fluid, in which are suspended innumerable particles of irregular size and form; these are called milk globules, and vary in diameter from the three thousandth to the twelve thousandth of an inch. These, when the milk is shaken with alkalis or with ether, are dissolved, showing that they consist of oily matter, and they are in fact the cream, which when further acted upon by agitation becomes butter. In addition there are still seen smaller masses floating in the fluid which are either very minute oil particles or undissolved cheesy matter. In the milk of newly delivered animals globules are also observed, much

larger than either of the above, which are called colostric corpuscles. This milk is found to have a purgative effect, and when given freely to infants often causes diarrhœa.

The quantity of these globules varies very much, not only in the milk of different animals, but in a less degree in that of the same species and even in individuals at different times. Their number is a very good guide in regard to the richness of the milk, for it has been observed that they not only show the quantity of fatty matter present, but that they also bear a very uniform proportion to the quantity of other nutritious matter in the milk, so that the more cream present, as a general rule, the richer is the milk in all its other constituents. — (Donné.) Though this is not strictly and uniformly true in regard to every cow's milk, it is generally so, and serves as a useful guide. It is not, however, the microscope which is the best or most available test of the goodness of milk for non-professional persons. I shall in the course of this chapter point out simple and adequate means by which every family may protect themselves against the most common frauds practised in this article.

The chemical components of milk are the same in all animals, but their proportions vary. First, however, let me name and describe them. In 1000 parts, cow's milk of an average quality contains, —

Water	873
Casein	48
Sugar of milk	44
Butter	80
Phosphate of lime	2.30
Other salts	2.70
	1000

Casein is an albuminous substance not differing greatly in its nature from the white of eggs, the fibrin of meat, or the gluten of wheat. They are what are styled by the chemists the albuminoid* nitrogenous substances, and are most important constituents of our food. Many regard the white of egg as entirely innutritious, but this is a great mistake; both the white and the yolk furnish important elements to the system. The first three substances named (casein, albumen, and fibrin) are easily transformed into each other, and are therefore often called "protein-bodies." Casein is separated from the other constituents of milk by coagulation, forming curd. This is usually effected by adding an acid substance, sometimes vinegar, but more commonly an infusion of *rennet*, which is the inner membrane of the fourth stomach of the calf, and contains the acid gastric juice. Alkalis also coagulate milk, but they are not often used for that purpose.

From curd, cheese is made. The richness of

* *Albuminoid*, that is, like albumen.

cheese depends upon the quantity of fatty matter or butter which is entangled in the casein when it coagulates. When the cream is entirely removed from the milk, previous to its coagulation, the cheese is hard and horny, and a variety of this character, known in England as *Suffolk bank*, "often requires an axe to cut it, and is so hard that pigs grunt at it, dogs bark at it, but neither of them dare bite it." The average percentage of casein in different kinds of milk is as follows: —

Cow's milk	4.8
Ewe's milk	4.5
Goat's milk	4.0
Ass's milk	1.8
Human milk	1.5

"It thus appears (says Mr. Lewes*), we hope without derogation to human dignity, that ass's milk is considerably more like that on which we are suckled than any other milk."

Milk sugar resembles in its composition the cane, grape, and other sugars, in fact it is chemically identical with the former, yet in their sensible qualities they differ considerably. Milk sugar is hard and gritty, and is less soluble and less sweet than cane sugar. It is prepared by boiling whey to a small quantity and setting it aside. As it cools the milk sugar crystallizes upon the sides of the vessel. It

* Physiology of Common Life.

is made in considerable quantities in Switzerland, chiefly for the use of the homœopathic practitioners, in whose ordinary preparations, indeed, it is the only substance which can be discovered by the most delicate chemical tests. The average percentage of this sugar in different kinds of milk is as follows: —

Cow's milk	4.4
Ewe's milk	4.2
Goat's milk	4.4
Mare's milk	8.7
Ass's milk	4.5
Human milk	5.0

It will thus be seen that mare's milk contains about double the amount of sugar present in the other varieties. Simon's investigations show that it diminishes according to the length of time after delivery at which it is secreted, and that neither an abundant nor an insufficient diet influences its quantity, although differences of food considerably affect the amount of butter. — (Lehmann.)

Butter is well known. It rises to the surface of milk, when left undisturbed, in the form of cream. By agitation, in a suitable vessel, the pellicle which encloses the fatty globules of this cream is broken, and the butter agglutinates into a solid mass. The proportion of butter in milk is subject to greater variation than that of any of its other constituents. The following are approximate average percentages: —

Cow's milk	3.0
Ewe's milk	4.2
Goat's milk	4.2
Mare's milk	6.9
Ass's milk	1.2
Dog's milk	10.7
Human milk	3.4

The quantity of butter is considerably greater in the milk last drawn. This has been supposed to be the result simply of the greater lightness of the cream, causing it to collect in the upper part of the udders of animals, while the heavier and more watery parts accumulate below it; but this will hardly account for the same fact in regard to human milk, which is nevertheless well ascertained to exist. The true reason may be that the process of withdrawing the milk especially stimulates the secretion of the fatty globules.

The phosphatic and other salts of milk, though existing in small proportion, yet fulfil very important uses in supplying the wants of the animal system. The former are supposed to be especially directed to the nutriment of the bones.

Having now very briefly stated and described the different substances which go to constitute milk, it is proper before speaking of the artificial adulterations to which it is subjected, to mention the changes which it may undergo as the results of the food, and the condition as to comfort and health, of the animal from which it is drawn.

Milk, when freshly drawn, is white, or yellowish white, according to the season. But some articles of food are capable of somewhat modifying this color; thus, saffron, madder, or the buttercup may give it a deeper hue when they are mixed with the food of the cow. The latter, however, is the only thing likely to be often the cause of such an appearance, and that only in the summer. This plant when it is eaten in sufficient quantities to affect the color of the milk, will also give it a nauseous taste and injurious properties. When milk, especially in winter, is seen to be very yellow and "rich looking," it is almost sure to be artificially colored, and it is well to know that in this way milk diluted with three times its bulk of water may yet have the color of cream. Bearing this in mind, purchasers need never be misled by this very common fraud.

When cows are fed upon distillery slops, brewer's grains, potatoes, and other watery roots to the exclusion of a proper proportion of grass, grain, or hay, the milk is blue and watery, but this is so easily corrected by a little artificial color that it is of no value as a test, — as I have remarked, the poorest milk may be made to have the richest color. Many housekeepers are entirely ignorant of this fact, and guided by the eye alone, fall easy victims to fraudulent milkmen.

Close and filthy stables, fermenting food, many

noxious weeds, turnips, onions, garlic, acid apples, cabbage, the leaves of some trees, especially the ash, impure water and filthy utensils, each or all may communicate an unpleasant taste and smell to milk, differing entirely from its natural agreeable flavor and aroma; but city people are so accustomed to bad smells, that what would be noticed at once by a farmer's wife as indicating something wrong, passes unobserved in a city kitchen.

The milk produced by cows kept in a confined, often filthy and ill-ventilated stables attached to distilleries and breweries, where they are fed entirely upon the distillery slop and brewers' grains, is noticeably offensive to a delicate taste and smell, even when fresh, and it quickly passes into putrefaction, unless kept at a very low temperature. Fortunately, all milk from such sources is thin and watery, and my readers will be furnished with an infallible test for such milk, in addition to those I have mentioned, which to many noses and palates are not available. The milk is a secretion easily affected by the bodily comfort and passions of the animal secreting it. Puppies, when nursed by their mother after a fit of rage, have been known to sicken and die. Cows are of a more equable temper than dogs, yet doubtless uncomfortable quarters, ill-treatment, and cruelty unfavorably influence the character of their milk. The following case,

related by Dr. Von Ammon, physician to the king of Saxony, has been often repeated, but may be new to some of my readers, and serves to illustrate this point. "A carpenter quarrelled with a soldier billeted in his house, and was set upon by the latter with his drawn sword. The wife of the carpenter at first trembled from fear and terror, and then suddenly threw herself furiously between the combatants, wrested the sword from the soldier's hand, broke it in pieces, and threw it away. During the tumult, some neighbors came in and separated the men. While in this state of strong excitement, the mother took up her child from the cradle where it lay playing and in most perfect health, never having had a moment's illness; she gave it the breast, and in so doing sealed its fate. In a few minutes the infant left off, became restless, panted, and *sank dead on its mother's bosom.* The physician, who was instantly called in, found the child lying in the cradle as if asleep, and with its features undisturbed; but all his resources were fruitless. It was irrecoverably gone."

The changes which take place in milk under these circumstances, and those hereafter mentioned, where disease and death have followed the use of milk from diseased cows, are not of a character which admit of detection by either chemical or microscopical means. The fine and virulent animal poison,

like the fatal malaria of swamps, or the miasm of contagious and infectious diseases, eludes the most delicate tests which art has yet been able to employ. But while this pernicious element, so elusive yet so destructive, cannot be isolated, yet, in those cases where such milk is produced in large quantities, as from distillery stables, its low specific gravity, which nothing can conceal, is easily shown by the instrument which is described further on.—the lactometer. From the milk of cows diseased under other circumstances, where there is nothing in the food and manner of keeping to reduce its density, this instrument is of course no protection. Fortunately disease which affects the milk is not very common among cows which are properly kept, but if children are found to suffer from bowel complaints, indigestion, or other disturbance of the alimentary canal, it is well to remember that milk, even when by all tests it appears perfectly good, may yet contain some subtle poison, and it should therefore be changed. In many cases this alone is sufficient to arrest alarming symptoms which all other remedies fail to reach.

The distillery stables of New York, where cows stand in hundreds and even thousands, as closely as they can be packed, surrounded by liquid filth, in low unventilated buildings, fed almost entirely on the hot slop from the whiskey stills, and in every

stage of disease and rottenness, have attracted the attention of persons interested in sanitary reform and the prevention of disease, ever since they were first begun.

In 1842 Mr. Robert M. Hartley published in New York a volume of 350 pages, entitled "An Historical, Scientific, and Practical Essay on Milk, as an Article of Human Sustenance; with a consideration of the Effects consequent upon the present Unnatural Methods of producing it for the supply of Large Cities." In this book, which is prefaced by highly commendatory letters from many distinguished men, among others from Drs. Charles A. Lee, John W. Francis, and D. M. Reese; Rev. Alonzo Potter and Rev. Eliphalet Nott, Mr. Hartley gives the results of considerable study and research, and makes a useful and readable compilation of all that was then known of the history, physiology, and chemistry of milk. But the most interesting, original, and practical part of his work, is that devoted to the subject of distillery milk. Mr. H. had previously (1836–7) published a series of essays on the same subject, which he says was the first attempt ever made to call the attention of the public to it. After the publication of this book the matter was occasionally agitated in the newspapers, but without effect, the abuses becoming greater, rather than less. The wealth of the men engaged

in the business, enabled them so to influence legislation as to prevent the enactment of any laws calculated to do away with this profitable iniquity. Subsequently Mr. John Mullaly published a book upon "The Milk Trade in New York and vicinity," wherein the matter was again laid clearly before the public, and in May and June 1858, the publisher of a well-known illustrated newspaper took up the subject, exposing all its enormities pictorially and verbally, and even giving the routes of the milk wagons driven from these establishments, with the addresses of their customers.

The vivid appeals which the pictures of diseased, ulcerated, and dying animals made to the imagination of the readers of this paper, had an effect far greater than any previous efforts to arouse the public feeling, and for awhile the business appeared to be upon the point of being broken up. Petitions were sent in to the city government; a special committee was appointed by the Board of Health; and the people entertained a hope that something was really to be done to suppress an infamous traffic which had been one of the chief means of raising the infant mortality of New York from one third, in 1843, to *five eighths*, in 1856, of the total number of deaths. The figures of the latter year, as given by the city inspector were,—

Deaths under 5 years of age . . .	13,373
" over " " " " . . .	8,285

From the bills of mortality in British cities it was shown at this time that the infant deaths in New York were eight per cent. above Glasgow; ten per cent. above Liverpool, and nearly thirteen per cent. greater than London; and the percentage in those cities was decreasing while that of New York was increasing. The crowded, unventilated, and filthy condition of the distillery stables, the horrible disease and mortality existing among the animals there, by which their tails rotted off, their horns and hoofs became diseased, their teeth destroyed, and their death, always within a year and often within three months, rendered certain, were all shown before this committee. The most eminent among the medical body of the city testified to the deleterious and fatal effects of this milk upon children, and the impossibility of maintaining the health of animals kept and fed as these were, yet three of the committee, Aldermen Tuomey, Reed, and Tucker, united in a report wherein they state that the cows in these stables were in a "general good condition," that they were "unable to ascertain a single instance where a child had sickened or died from the effects produced by drinking milk," and that "chemical analyses establish the fact that no deleterious or poisonous element can be verified either in the milk secreted or in the swill itself." They therefore merely recommend that each cow shall be allowed

a space of not less than five feet wide. This was all the remedy they saw fit to suggest for this enormous evil. One of the committee, however, Mr. Charles H. Haswell, submitted a minority report, where, after detailing the personal observations of the committee and summing up the evidence brought before it, he "is led to the following conclusions: —

"*First* — That the restricted manner in which the cows are stalled, and the stimulating character of their principal food, added to their unvaried confinement in a warm and humid atmosphere, cannot fail to produce a condition of their system adverse to the secretion of milk of a character suitable to be given either to children or adults.

"*Second* — That distillery-fed cows are subjected to a peculiar communicable and eruptive disease, and that during the existence of it their milk is liable to be collected in common with that from other cows, and dispensed to the public.

"*Third* — That the herding together of great numbers of cows, and the feeding of them in a manner highly stimulating to their secretory organs, coupled with the want of cleanliness and responsible attendants, is calculated to induce results and practices not only opposed to the requirements of health, but so repugnant to propriety, as to preclude the further consumption of milk, were the abominable risks to which it is exposed fully known to the public.

"*Fourth* — That the disease peculiar to stalled and swill-fed cows adds so greatly to the cost of maintaining them, that the opportunity of obtaining some remuneration for their loss by the sale of their carcasses is too tempting to the cupidity of many to be successfully resisted, and consequently the opportunities and incentives to dispose of diseased meat to our citizens, are greatly increased by the existence of distillery cow stables.

"*Fifth* — That the existence of distillery cow stables involves an additional element of discharge into our harbor, calculated to add very essentially to the reduction of its depth of water.

"In view, then, of the existence of these numerous evils, consequent upon the herding together and feeding of cows in the manner under consideration, I submit the following resolution, and recommend its adoption:

"*Resolved*, That the counsel to the corporation be and is hereby required to submit to this board, as early as practicable for him to do so, an ordinance or ordinances calculated, in their observance, to prevent the stabling, south of One Hundred and Twenty-fifth street, of more than two cows upon the premises of any one person or any number of persons, where there may be a joint ownership of the premises. CHARLES H. HASWELL."

Whether honest men could, from the same evidence, arrive at such diverse conclusions, I leave to the reader's judgment, as well as the question whether, in case undue influence is suspected, Messrs. Tuomey, Reed, and Tucker, or Mr. Haswell, were most open to the suspicion of bribery. However that may be, in this case, as in most others where in large cities the public welfare comes in collision with the interests of wealthy individuals or corporations, the public welfare went down, "and bloody *money* triumphed over it." From the best sources of information I learn that this legalized system of public poisoning still continues in all its atrocity, unchecked and growing daily worse and worse. Mob-law is a horrible evil, yet the people of New

York, left thus unprotected in their dearest rights by the legal authorities, would hardly be condemned by public sentiment if they should take the redress of their wrongs, so long and patiently borne, into their own hands.

It hardly seems necessary in addressing persons of ordinary common sense, yet it will do no harm, to show just how and why it is quite impossible that the milk from distillery stables should be fit food for any living creature.

In these stables from three hundred to two thousand cows are kept. When once taken in these animals rarely go out alive. They may *be taken out* while yet a little life remains in them, to be slaughtered for beef, at the very idea of which we shudder, but, as I say, they rarely *go* out after once entering these black holes. The suffering animals stand in the low unventilated buildings so closely, that it is impossible for them to lie down without lying upon one another. They breathe over and over again the same air, tainted with the exhalations of their own fevered bodies, and of the unutterable slimy filth voided from their diseased and ulcerated intestines. What the effect of this is, even where the want of ventilation is not great, and where the cows have out-door exercise, is shown in the Pleuro-pneumonia which attacked the cattle of Mr. Chenery in this State not long since, and, by its apparently conta-

gious nature, excited so much alarm. Now every cow from these distillery stables is found, when opened, to be suffering with diseased lungs, the condition of which does not materially differ from those of Mr. Chenery's herd which were examined. What is known as the "hog-cholera" in the West is the same disease, originating in the piggeries attached to the great distilleries which exist in those States. This disease, when it has once been established among a large collection of animals, appears to be slightly contagious, that is, from the bodies and the breath of the diseased animals, other animals, even when in places where there is no danger of the disease originating spontaneously, may contract the infection; but here, so far as evidence goes, the power ceases. Mr. Chenery's cattle had been imported from Holland, where swill stables are not unknown (one was burnt down by a mob near Elberfeld on the Rhine in 1848); they had been closely confined in the hold of the ship on their voyage, and on their arrival were taken to an ill-ventilated stable. Here the disease, obscure at first, finally burst forth with virulence. Now this disease is, and has long been endemic in the distillery stables. The type is not identical, it is true; for the food, and the excessive filth of those places give it an intensity unknown elsewhere, and complicate it with other affections of an almost equally malig-

nant character. But dissection reveals it to be essentially the same disease. As I have said, it is not confined to neat-cattle; hogs and horses suffer also from its ravages.

Not less than fresh air, exercise is essential to the health of every living creature, — exercise according to its nature, — and without it, it is vain to hope that health can long be maintained. In distillery stables, exercise for the cows immured there is of course out of the question. There they are tied, and there they stand, until the butcher's knife is called in to anticipate by a few hours the natural termination of their miseries.

Jenner, and more recently Dr. Baron, have shown by a series of experiments, the baneful results upon animals of their deprivation of natural exercise, and a free range for food. Dr. Baron confined perfectly healthy rabbits, feeding them upon coarse green food, such as cabbage and grass. In about a month one of them died, and the first step of disorganization was shown in numerous transparent vesicles studded over the liver. In another, dying nine days after, the disease had advanced to the formation of tubercles on the liver. The liver of a third, which died four days later still, had nearly lost its true structure, so universally was it pervaded with tubercles. In two days a fourth died, even more diseased. At this time Dr. Baron removed three

young rabbits from the place where their companions had died to another situation, dry and clean, and to their proper and accustomed food. Their lives were saved by this change. He obtained similar results from experiments of the same nature performed on other animals.

"Nature, ever unerring in her instincts, prompts the bounding frolics of young animals, as well as the more clumsy gambols of the old. 'There must,' remarks Addison, 'be frequent motions, agitations, to mix, digest, and separate the juices contained in the body, as well as to clear and cleanse that infinitude of pipes and strainers of which it is composed, as to give their solid part a more firm and lasting tone. Exercise ferments the humors, casts them into their proper channels, throws off redundancies, and helps nature in those secret distributions, without which the body cannot subsist in vigor.' And in order to this healthy action of the vital functions, it is not sufficient that exercise be taken occasionally, and at long intervals, but, when the season permits, it should be taken daily. Common sense and observation, independent of physiological knowledge, might lead us to the conclusion, that any other management of cattle than that here suggested, must lead to the derangement of health, and fatal diseases." — (HARTLEY.)

Cows belong to the order of the *Ruminantia*, or

cud-chewing animals, and their natural food is such as is susceptible of that process, — herbage, grass, and hay. With this may be mixed a certain quantity of grain, roots, or even soft and liquid food, but not to the extent of making these their chief, much less their only sustenance. Distillery slop is perhaps the most unnatural food that ingenuity could devise upon which to feed a ruminating animal. With every other appliance of health and comfort, pure air, pure water, abundant exercise, and suitable quarters, it would be impossible to preserve the health of such animals when fed exclusively, or in great proportion, upon such food. They must soon sicken and die. But when this is added to the crowding, the filthy floors, the foul air and confinement of distillery stables, animal martyrdom can be carried no further.

To fulfil the obvious design of nature, these animals must have food which requires mastication. What is the result of withholding it from them? The distillery slop (which is fed to the cows as hot as they can swallow it) is the only food and the only drink which they receive, as a usual thing, in the swill stables. The most obvious effect of withholding dry food and substituting hot slop is the destruction of the teeth, thus in a short time rendering it impossible for the animal to be again fed on proper diet.

Dr. John Burdell, a dentist of New York, whose observations were confirmed by Dr. J. R. Dilling ham, of Boston, has published in his work on Diseases of the Teeth, a statement, with illustrations on wood, of the effect of this diet upon the teeth of cows subjected to it. He affirms that it unfailingly and rapidly destroys the whole enamel, and finally the bone ; the jaws become affected, and ulcers form at the roots of the teeth, which are ultimately completely destroyed if the animal survives.

In addition to the destruction of the teeth, the cow has been an inmate of a swill-stable but a few days before a profuse diarrhœa is established. This goes on unchecked until it results in extensive ulceration of the intestines, which alone would in most cases destroy life, did not the more rapid disease which attacks the lungs forestall its result.

" Such, then, as described, is the barbarous and unnatural treatment of this inoffensive and unfortunate animal, that is destined to supply us with nutriment, both when living and dead, and which is one of the most valuable gifts of Providence to ungrateful men. Here, in a stagnant and empoisoned atmosphere that is saturated with the hot steam of whiskey slop, and loaded with carbonic acid gas and other impurities arising from the breath, the perspiration and excrements of hundreds of sickly cattle, they are condemned to live, or rather die, on rum-

slush. For the space of *nine months* they are usually tied to the same spot, from which, if they live so long, they are not permitted to stir, excepting indeed, they become so diseased as to be utterly useless for the dairy. They are, in a word, *never unloosed while they are retained as milkers.* In some few cases the cattle have stood in the same stalls for fifteen or eighteen months; but so rapid is the progress of disease under this barbarous treatment, that such instances are exceptions to the general rule, and of very rare occurrence. Facts show that all the conditions necessary to the maintenance of health and life, are recklessly violated to an extent which, if not well authenticated, might appear incredible in a Christian community." — (HARTLEY.)

It seems absurd to say any thing about the pernicious effects which must arise from partaking of milk secreted by animals under the circumstances which have been described; but considerable stress has been laid upon the fact that chemical analysis can discover no specific poison in this milk. This has even been regarded as an unanswerable argument by some, and is brought forward in the majority report of the Committee of the New York Board of Health, quoted above. How futile it is, when opposed to incontrovertible facts, and the experience of every physician, I need not say. It is true, chemistry cannot extract a poison from swill-milk. Neither can it

find any difference between the fatal air of the Campagna of Rome, where yet to pass a single night is fatal, nor the equally deadly air of the African coast, nor the air of a small-pox hospital, nor that of a city devastated by the plague, the cholera, or yellow fever, and the purest air that blows across the mountains. Shall we then be persuaded that those airs possess no noxious properties? Chemistry, as a science, is in its infancy, and it is in the highest degree absurd to argue that because it cannot yet detect these subtle poisons, they therefore have no existence.

Christison, in his work on poisons, states, that "it has several times been remarked on the continent, that the milk of the cow may act like a violent poison, although no mineral or other deleterious impregnation could be detected in it." He gives several instances in confirmation of this remark, but it seems quite unnecessary to bring additional proof of what must be self-evident, not only to physicians, but to every person of common sense, — that the milk of diseased animals cannot be used for food without risk to health and life; and every humane mind will agree in the verdict that those persons who continue to furnish it to be so used, with a knowledge of its pernicious qualities and effects, should suffer a punishment proportioned to the enormity of their offence.

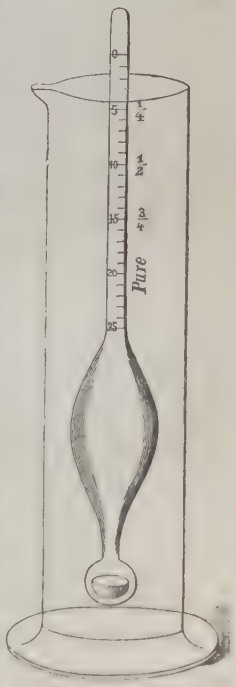
Turning from the sickening horrors of the swill-milk stables, we have to mention the adulteration most commonly practised in the milk business. This is a fraud upon the pockets of the community of no small consequence or amount. It chiefly consists in the admixture of from twelve to fifty per cent. of water with the pure milk, or, to use the language of the trade, "from eight-one to splitting it right in two."

It is surprising to see how much water may be added to milk without detection by the senses. A mixture one third or one half water, slightly salted and colored with burnt sugar, will pass with most persons for genuine milk: it tastes well and looks well, and we have seen people quite indignant at what they regarded as a reflection upon their judgment, when they were told that the milk supplied to them was one third water. It is really hard to make people believe that *their* milk-man is not honest. These are generally very smooth-tongued fellows, they understand human nature, and especially that variety of it called woman nature, well. There is only one thing that they fear, which is the introduction into families of that cheap and simple little instrument before which their tricks stand self-revealed, — the lactometer. Consequently they use every means to impair the public confidence in it. They have even gone so far, when they

could not prevent people from purchasing them, as to bribe the manufacturers to graduate them falsely, and thus enable them to continue their profitable fraud undetected.

Feeling the necessity of some simple and universal test of the purity of milk, so far as the admixture of water is concerned, I have spent much time and labor in submitting the lactometer to a thorough trial; and, commencing with many doubts of its availability, I have now come to the conclusion that, with the limitations which I shall point out, it may be regarded, practically, as an infallible test.

The annexed wood-cut represents this simple instrument, within the glass vessel in which it is most convenient to use it, as requiring but a small quantity of the milk to be tested. The lactometer is a specific gravity instrument for fluids, or hydrometer, but having a graduation peculiar to itself. It is made of glass, the bulb at the bottom containing mercury or shot, to maintain it upright



LACTOMETER AND GLASS.
(*Reduced one half.*)

when floating in the milk. The stem is graduated from 0 to 25. 20 corresponds with the ordinary specific gravity of pure milk, and very nearly with 1030 on the ordinary hydrometer scale. 15 is the point at which the instrument floats in milk, which is adulterated with 25 per cent., or one quarter, water; 10 shows the presence of one half, and 5 of three quarters water, and in pure soft water at the ordinary temperature it floats at 0.

In using this instrument it is only necessary to have sufficient milk in a vessel in which it will float freely. The milk should be at a temperature of about sixty, Fahrenheit: that is, a little less than the ordinary temperature at which a room is kept in winter; if it is warmer it should be cooled by placing the vessel containing it in cold water. The temperature is important, as milk warm from the cow, or artificially warmed to the temperature of the air on a hot summer day, will not stand higher on the lactometer scale than fifteen. From sixty degrees down to freezing, the change is much less, so that it is chiefly important to see that the milk does not exceed that temperature. Then place the instrument carefully in the milk, and note the mark at which it stands, and if your milk-man is cheating you, call him in and let conviction stare him in the face.

There has been considerable discussion as to the reliability of the lactometer, based upon the fact that milk unusually rich in cream will range low upon its scale, while milk entirely deprived of its cream will still maintain its specific gravity, and even appear more dense than unskimmed milk. Both these statements are unquestionably true, and, viewing the subject from the theoretical stand-point, I was at first disposed to believe that for this reason the instrument could not be made generally useful as a test. But I determined to give the matter a thorough practical investigation, for the purpose of discovering, if possible, whether any means whatever could be found by which frauds of this kind might be checked.

My readers are by this time aware that I award a high degree of credit for accuracy to the researches of Dr. Hassall. So far as he has carried those researches in the investigation of the adulteration of milk, I believe him to be equally accurate and conscientious. But with all this, I have never allowed myself to adopt any of his statements in regard to the adulterations treated of in this book, without a careful and repeated personal verification. It would have been an easy matter to make a compilation from Dr. Hassall's work of English adulterations, and to assume, as is the fact, that most of them are also practised in this country; but this did not satisfy me. I have determined to publish noth-

ing as fact, which I do not know to be true from personal investigation.

The knowledge of one circumstance, in particular, urged me to study thoroughly the point in dispute in regard to the lactometer, of which Dr. Hassall does not think highly; — this circumstance was, that it is universally and almost solely used as a test by the milk-men themselves, in their dealings with farmers and dairymen. Now if the milk-men regard it as a reliable instrument to check the frauds of those whom they buy of, what is the reason which should prevent their customers from making use of the same means in their own behalf?

Dr. Hassall made several experiments upon the milk of different cows, and he reports them in his work upon *Food and its Adulterations*. I reproduce them complete, with his remarks, that my readers may see the only grounds upon which those writers in the newspapers, in the employ of the milk-dealers, have to stand upon, who assert the unreliability of the lactometer. First, Dr. Hassall examined the milk of eight different cows to ascertain the variation in specific gravity between the first and last milk obtained at each milking.

FIRST MILK.

Cows.	Milk — Specific gravity.	Cream — per cent.
1	1027	9
2	1026	13
3	1027	8
4	1029	7
5	1030	11
6	1030	8
7	1029	3½
8	1031	2
		61½

SECOND MILK.

1	1033	25
2	1023	22
3	1025	10
4	1024	15
5	1024	32
6	1022	25
7	1026	7½
8	1030	5
		141½

It will be seen by this table that the specific gravity of these samples varies from 1024 to 1033 (by the lactometer scale from 16 to 22*). It is not stated, and it is an important element, whether a small quantity of the very first and a small quantity of the very last milk was used, or whether it was divided as equally as possible into two portions. Nothing is said, either, about the temperature at which it was tested; but it is worthy of notice that

* One degree of the *lactometer* is equivalent to one and a half on the *hydrometer*; the scale of the latter commences at 1000, of the former at 0.

the poorest first drawn milk (No. 2) marks only as low as 18 on the lactometer scale (1026 of the hydrometer), and that richest in cream (No. 5, 2d milk) would have marked nearly 17 on the lactometer; while if all the milk had been poured together, as is the case in that usually brought to market (allowing that equal quantities of each milk were tested, and the quantity from each cow did not materially vary), the lactometer would have stood in it at about 19. This variation of one degree may have been due to temperature, or it may have been owing to these cows being in part fed upon brewers' grains, which are calculated, like distillery slop, to increase the quantity at the expense of the quality of the milk.

Dr. Hassall then gives the following

"TABLE SHOWING THE SPECIFIC GRAVITY OF PURE MILK, AND THE PERCENTAGES OF CREAM.

MORNING MILK.

Cows.	Specific Gravity.	Cream.
1	1030	6½
2	1031	7
3	1028	4½
4	1030	9
5	1031	10
6	1028	7½
7	1030	12
8	1023	5
9	1029	7
10	1028	9
Average nearly	1029	Total, 77½ Average about 7½.

AFTERNOON MILK, SAME COWS.

1	1028	7½
2	1027	10
3	1027	6
4	1028	9
5	1028	11½
6	1027	7½
7	1028	22
8	1026	6
9	1026	6
10	1026	11
Average about	1027	Total, 96½ Average about 9½."

The first six cows in each table were fed partly on grass and partly on brewers' grains; the last four were London cows, and their feed is not specified; their milk seems to indicate grains or slop. Temperature not specified.

It will be noticed that in but one instance (No. 8, morning milk) did the milk here tested fall more than a trifle below 18 of the lactometer; in that case (a London cow) it is down to a little less than 16 in the morning; but the same cow, in the afternoon, when all the others ran below the morning test, gave milk over 17, so that there is reason to suspect a mistake or some peculiar cause for the exception. The average of all this milk, poured together as customary, was by the hydrometer 1028, or nearly 19 of the lactometer scale, which is fair for cows partially fed on brewers' grains. By noting Nos. 5 and 7 in the milk of this table, both morning and even-

ing, it will be seen that the presence of a large quantity of cream does not always reduce the specific gravity of milk, as is asserted. This is due to the fact, ascertained by Dr. Donné, and mentioned on page 156, that increase of cream is usually accompanied by increase of casein and sugar, which, by their density, counterbalance the levity of the cream.

But Dr. Hassall's last table, upon which the most reliance has been placed as showing great variation, is as follows: —

"TABLE SHOWING THE VARIATION IN THE SPECIFIC GRAVITY OF GENUINE MILK, AND THE RELATION OF THIS TO THE PERCENTAGES OF CREAM.

No. of Cows.	Milk, Specific gravity.	Skim Milk. Specific gravity.	Cream. Per cent.
1	1031		2
2	1029		2½
3	1019	1027	26
4	1008	1026	30
5	1030		2½
6	1027	1030	9
7	1026	1028	13
8	1029	1030	8
9	1030	1031	7
10	1024	1028	10
11	1027	1031	10
12	1023	1030	25
13	1024	1031	32
14	1025	1029	10

"The above table includes samples of both morning and afternoon milks, *as well as some of the first and last milk obtained at the same milking*: they are not therefore to be taken as average samples of milk."

The facts stated by Dr. Hassall in this last paragraph have been carefully suppressed by those who have made use of this table to show the uncertainty of the specific gravity test. It will be noticed that No. 4 was almost pure cream, and probably the last ounce or two obtained from the cow, while Nos. 3, 12, and 13, were also evidently "strippings" or last milk, obtained after a great portion of the first milk had been withdrawn. The other samples do not vary from the tables already given, bearing in mind that some of them are first milk, and consequently, as Dr. H. plainly states, not fair samples.

My readers have now seen the worst that can be said against the lactometer. I will proceed to give the results of my own experiments.

I have visited the freight cars which bring milk into the city of Boston from different country towns, some of them sixty or seventy miles away. These cars bring at each trip many hundred cans of milk. I have tested the milk of dairy after dairy, to the number of fifty or more, and never found any of it to show a greater variation from the standard of pure milk on the lactometer scale (20) than three fourths of a degree. These cans contain of course the milk of different cows mixed together. I have seen the milkmen testing their milk repeatedly by the same instrument. The milk as it comes to the city is almost universally pure; the farmers have

found out that the milkmen have an instrument which enables them to detect fraud, and they do not attempt it. If the milkmen knew that *their* customers were equally awake to their interests, and knew the means of protecting them, they too would be forced into honesty.

But I have not been satisfied with the examination of the milk at the depôts. I have visited the large dairies in the vicinity of the city, and tested the milk from individual cows in great numbers, and I have yet to see a sample of pure milk at the temperature of 60 degrees that marked a less density upon the lactometer scale than 19.

Dr. Hassall was right in saying, theoretically, that an excess of cream would lessen the density of milk, other things being equal; but he seems not to have been aware of the discovery of Dr. Donné that, almost universally, the heavier constituents keep pace with the cream, and so the density of pure milk, *taking the whole milking together*, remains the same in nearly every case. My investigations have been sufficient to satisfy me that *the lactometer is for ordinary milk a perfectly practical test.*

To confirm my own observations, and to give my readers the benefit of a much more extended series of experiments than my own, I am permitted to publish the following letters. The first is from Mr. George O. Brigham, who was for many years con-

nected with the well-known "Westboro' Milk Company," although he is not now, I believe, in any way interested in the purchase or sale of milk. I can therefore append his name to his interesting communication without exposing myself to the imputation of puffery, which, as well as its opposite, personal invective, I think my readers have done me the justice to observe, I have carefully avoided; striving to treat every question solely on its merits. The other letters are from individuals still engaged in the business, and I therefore refrain from publishing their names; but those who wish to verify their genuineness I should be happy to satisfy, on personal application.

BOSTON, November 16, 1860.

DEAR SIR, — In reply to your inquiries as to the *fact* of the adulteration of milk sold in Boston, the substances used, and the means employed by milkmen themselves to test the purity of milk, I reply that it is undoubtedly a *fact* that milk is daily adulterated, and sold by some of the milkmen in Boston, and it is also a fact that others sell a pure article.

To the second inquiry with regard to the substances used, I reply that, as far as I know, water is the only article used to increase the quantity, burnt sugar for coloring, and common salt to give the mixture a more lively taste, and also to bring it nearer to the specific gravity of pure milk. If any other substances are used I am not aware of the fact.

With regard to the means used by milkmen themselves to test the purity of milk, I answer that they use the instrument known as a lactometer, or milk essayer. The instrument in common use

for this purpose, is graduated so that 20 marks pure milk. I do not think any other practical means is known to them by which to test the purity of milk.

You request me to give you the results of any experiments which I have tried with the lactometer in the course of business. I was engaged in the milk business most of the time from the year 1845 till the fall of 1858, though it was not till about the year 1853 that I became acquainted with the merits of the instrument known as the lactometer. My first experiments were to ascertain if the instrument was properly graduated. This I did by trying it in pure milk, and then adding water, measuring the quantity added. In each instance the instrument indicated the exact quantity added. I then tested the milk of from eighty to one hundred farms, from which we at that time obtained our supply, nearly all of which milk sustained the lactometer at the point which marked pure milk. In a few instances, in this large number of dairies, I found specimens which the instrument showed to be adulterated, and I at once took measures to more fully satisfy myself. For this purpose, I went directly to the farmers who put up this milk for us, taking for my visit a time in the day when their milk was ready for the market (that is, put up in cans), and told them that the milk which they sold us was adulterated, which statement they invariably denied, or said they had no knowledge of it. I then tested the milk in the cans, and finding it to be below the standard, requested them to milk their cows, in my presence, that I might compare the milk with that in the cans. In each of these instances, and in several of a similar character since, the farmers yielded the point, and promised to do better in future. The next day's milk from these farms sustained the lactometer to the point which marked pure milk. The same experiment has been tried by other men in the business with the same result. I have known a few instances in which pure milk, or, in other words, milk which I knew came from cows to mark as low as 18½ degrees on the

lactometer, but in all these instances the cows were fed in part on potatoes, oil-meal, brewers' grains, or some other feed which forced the cow to give more than her ordinary quantity of milk. During the season when cows get their living in the pastures, or when fed on good hay and Indian corn, I have been able to find scarcely any variation in the milk by the lactometer. A few days since, having in view answering your communication, I went to a depôt in the city where large quantities of milk are daily received from different towns many miles apart, and tested the milk from some fifty different dairies, as it was taken from the cars, and in all did not find an instance in which there was a variation of more than one half a degree by the lactometer. I do not think this instrument is of much use in detecting skim-milk, but for indicating adulterations by water, I know it to be of practical utility. In order to fairly test milk by the lactometer, it should be of the right temperature, and I think, to be perfectly accurate, it should be some twelve hours old. I have seen lactometers with false graduation, probably made by some unprincipled manufacturer of this class of instruments to accommodate some equally unprincipled customer.

Yours, respectfully,

GEORGE O. BRIGHAM.

Dr. T. H. HOSKINS, 69 Shawmut Avenue.

CHARLESTOWN, 26th November, 1860.

DEAR SIR, — Yours of the 17th, asking a reply to certain questions is before me; and to your first question, "Is milk commonly adulterated in Boston and its vicinity by dealers?" I would answer that I believe a large part of the milk sold in Boston and vicinity is adulterated, and I think it has been so for the past eight years or longer.

I know there are some, and presume there may be many who have not adulterated their milk, and who would not, knowingly,

sell an impure article: and I also have no doubt, there are many others, who make it a part of their regular business, from day to day, to adulterate the milk they intend to sell the next.

To your second question, "What are the substances with which milk is usually adulterated?" I will say that I believe water to be the principal, with something to give it the color and appearance of milk, and also to remove the watery taste.

To your third question, "In what proportion are they used?" I will answer that I do not know.

Fourth. You ask if I regard the lactometer as a reliable test for milk, such as is sold in this vicinity and in ordinary circumstances? I will say that I do regard the lactometer as a reliable test for milk in this vicinity or elsewhere.

Fifth. You ask, What I have found the extreme range of the lactometer to be in milk which I knew to be pure as drawn from the cow?

In one instance I found the instrument to stand at 18 (10 per cent. below par) in milk which I saw taken from the cow. In that case, the producer informed me that he had been feeding his cows on diseased potatoes. He ceased to feed the potatoes and his milk improved. I think in a very short time it came up to the standard.

Sixth. You ask, What is the general opinion among milkmen as regards the practical accuracy of the lactometer? I think that milkmen believe the lactometer to be a practical test, and I do not know of one, who I think would continue to take milk of a producer which that instrument showed to be adulterated.

I know of a number of instances in which the lactometer has done good service to dealers, who supply their customers with as good milk as they can get from the country.

I think it would benefit the consumers of milk to become acquainted with and occasionally use the lactometer.

Yours truly,

Dr. HOSKINS, Boston.

JAMAICA PLAIN, November 26, 1860.

DEAR SIR, — In reply to yours of the 17th, containing some inquiries in regard to the milk business, I would briefly reply that milk is commonly, though not universally, adulterated by the dealers in Boston and its vicinity. The substance used for that purpose is water; nothing else, except water, and burnt sugar for coloring, can be used to advantage.

I have used the lactometer in my business for six years, and regard it as a reliable instrument, — have always found it to tell the truth. In pure milk at the temperature of 60 degrees, I have never known it to vary materially from 20 upon the scale of the instrument. I think that all who have used the lactometer, and will express their opinion honestly about it, will admit its correctness and reliability. I have submitted it to many tests, and have found it in all cases not to vary materially from the truth in its testimony. If the above hurried reply to your questions will be of any service, you are welcome to them. I should have been glad, had time allowed, to go a little more into details.

Most respectfully yours,

Dr. T. H. HOSKINS, Boston.

BOSTON, November 25, 1860.

DEAR SIR, — In answer to inquiries contained in a letter received from you, I return the following: —

To your first question, I reply unequivocally milk *is* extensively adulterated in Boston and vicinity by some of those who deal in it.

The substances used for purposes of adulteration as far as I have any knowledge, are, water, burnt sugar, and common salt; water to increase the quantity, and burnt sugar and salt to give it a natural color, density, and taste.

I have never been able to ascertain the exact proportion in which these articles are used in forming the compound, except so far as regards the water, and this (the proportion of water) may be at once determined by the use of the lactometer. It is no uncommon thing to find that one third part of that which is sold for pure milk, is nothing more nor less than water.

As to the reliableness of the lactometer I have not the slightest doubt. My experience in its use has, to my mind, clearly demonstrated its accuracy; and all unprejudiced milkmen with whom I am acquainted, who have given this instrument a proper trial, have expressed full confidence in it as an accurate and practical indicator of the purity of milk.

Respectfully yours,

Dr. Hoskins.

Boston, December 1, 1860.

Dr. Hoskins — Dear Sir, — In regard to your inquiries in regard to the adulteration of milk, I would say from what knowledge I have of the business, that at least one half of the milk sold daily in Boston is adulterated. I think there is no day in the year where this would not be true, but that there are many in which it would greatly exceed that proportion; not that a greater number of men practise this when milk is scarce, but owing to the greater extent in which it is practised by those constantly engaged in it. Or, in other words, those who use water cautiously in June, use it freely in November and December.

But as the method of adulterating is simple, so is the means of detecting it. It is "extended" *nicely* with water, with a slight diversity with different dealers in preparing the water previous to mixing it with the milk. Some milkmen use nothing but salt in the water, but that class use but a small proportion of water to the quantity of milk, for if they used much water mixed in that

way, it would at once make trouble with their customers. Consequently the milk in the market that looks "a little blue," is really often better than that which looks "very rich." The next class use salt and sugar, the latter intended to give body and color to the milk, and the third use burnt sugar, or distiller's coloring in place of sugar. Some use all three.

But it will be seen at once, that none of these articles tend to raise the specific gravity of any fluid except salt, which does in a very slight degree, so that the lactometer will indicate the exact proportion of water used in every instance; and it is used by the milkmen to detect the amount of water in a can of milk, with as much confidence and certainty of a correct result, as they would use their measure to measure the water, out of the milk; that is to say, by the aid of a common milk essayer, water can be measured in a given quantity of milk as correctly as with a measure out of it.

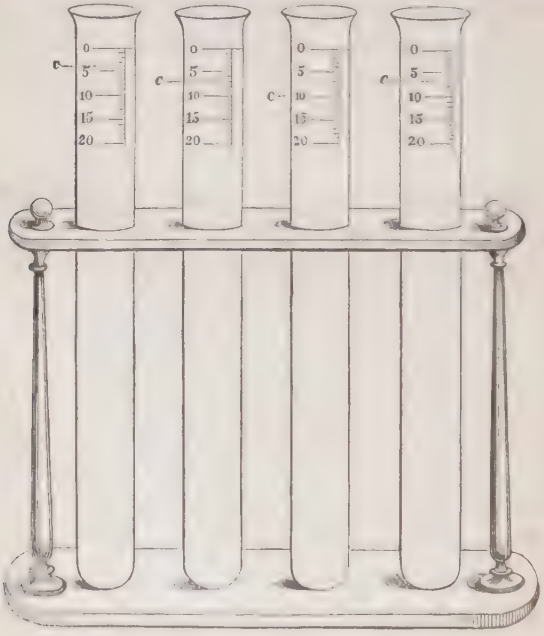
It may be asked whether there are no exceptions to this rule caused by the different qualities of milk from different cows and from various other causes? to which I would say that with several years' experience, I have never discovered any of importance enough to mention.

Yours very respectfully,

To those who wish to test for themselves the accuracy of the lactometer, a few simple directions and cautions are necessary. First, be sure that the instrument is correctly graduated. This may be easily ascertained by immersing it in pure soft water, — Cochituate or Croton, will answer, — at a temperature of 60°, and seeing if it floats with the surface of the fluid at zero. Then, if when tried in

one or two specimens of milk of known purity (properly shaken up to mix the cream, which should never be forgotten in testing milk), it is found to float at or very near 20, and on the addition of twenty-five per cent. of water at 15, and of fifty per cent. of water at 10, the instrument may be regarded as correct.

There are two slight sources of error which have been alluded to. The first is, that skimmed milk shows as well as, and even a degree or so better on



GALACTOMETER AND STAND — (*reduced one half*).

the lactometer than that which is unskimmed. But this, when suspected, is easily settled by setting some of the milk to rise, and seeing if it yields a fair proportion of cream, say eight to ten per cent. For ordinary purposes the eye is a sufficient guide in this; but for milkmen and others who wish greater accuracy, the *Galactometer*, of which a cut is appended, will enable them to attain it. This is simply a set of glass tubes, of any desired number, graduated as in the cut. They are to be filled with milk up to zero (0) and set away, where they will be undisturbed for ten or twelve hours. The cream will then be risen, and its proportion may be easily estimated. In the engraving the dotted lines show the quantity of cream in four different samples.

The other source of error arises from the fraudulent addition of salt to the milk; but I have found by experiment that it is not possible to add sufficient salt to raise the density of milk more than one degree of the lactometer, without giving it a perceptible saline taste. If salt is suspected, but the taste is faint, carefully evaporating a portion of the milk to one half, or one quarter, will enable any one to satisfy himself on this point; the reduction in quantity will develop the taste of the salt unmistakably.

Noting the simple directions and precautions I have given, every one may possess in the lactometer

a protection against any great frauds in milk. It also aids in confirming or dissipating suspicions of slop-milk, which will rarely mark as high as 17 upon the scale, and is often as low as 12, even when unwatered. Slop milk is also almost uniformly acid to test-paper (which may be obtained, with directions how to use it, of the druggists), while good milk, when fresh, is always alkaline. Whenever your milkman supplies you with milk which stands uniformly below 19 by the lactometer, you will commit no injustice in discharging him and taking another, with a premonitory warning that you *have* a lactometer. Great quantities of milk are sold, in all the large cities, watered one quarter, one third, and even one half; and it would take but a few weeks for any family to save the dollar or so which the instrument costs, to say nothing of the security against swill milk, which cannot by any method be made to stand this test. The lactometer may be obtained of almost any instrument-maker.

It is commonly believed that chalk, plaster of Paris, flour, etc., are added to milk, but I have never detected them, and hardly think they can be used, for they would soon settle to the bottom and attract the attention of even the most careless purchaser.

It has been publicly advanced by the defenders of dishonesty, that watering milk is but a harmless fraud; but even this, if we were disposed to accept

it as an excuse, is false. One of the writers in the daily papers, who signs himself "Justice," says:— "That milk thus adulterated (with water) is poisonous, as has been asserted, or destructive to children fed with it, nobody with a decent share of common sense believes, for, with the observation of a country boy ten years old, mothers are in the habit of reducing milk with water for young infants."

"Justice's" grammar is rather lame, though his meaning is plain enough. But the cases are not parallel between the mother and the milkman. The mother in the country, when she feeds her child, takes pure fresh milk, and diluting it with equally pure water, administers it at once. What security have we that even clean water is mixed with our city milk? But further, it is a well-ascertained fact that watered milk takes on the putrefactive fermentation much sooner than pure milk; and all physicians will bear me out in the statement, that nothing is more productive of disease and death among children than milk which has begun to ferment. A large portion of that which is sold to the poor of our cities during the warm season, is in this condition. When we add this to the pestiferous effects of swill milk, the wonder is that a child among them is left alive.

As well as is possible, within the brief limits of a single chapter, I have endeavored to state plainly

and temperately the known facts in regard to frauds practised upon the community in this most important article of food — milk. I have expended a great deal of time and labor in verifying a reliable and easy means for detecting them, which every purchaser may possess and use without more than the most ordinary care and skill. In this I think I have been successful, and I shall feel amply rewarded if the public will avail themselves of it. A lactometer should be held quite as indispensable in every city kitchen as a gridiron.

CHAPTER VIII.

REMEDIES FOR ADULTERATION.—CONCLUDING REMARKS.

I HAVE now laid before my readers an imperfect account of the more injurious and extensive adulterations practised upon the food and drink which they consume. How briefly, in comparison with what might be said, the subject has necessarily been treated in this little book, may be judged from the fact that the results of Dr. Hassall's investigations in London, where these frauds hardly extend to a greater number of articles than here, occupy two closely printed volumes of about seven hundred pages each.

But I think enough has been said to awaken the attention of those interested in the public welfare, which is so intimately connected with the public health, to matters that have been too much neglected and left to take care of themselves until abuses have crept in which have produced, and must continue to cause the most serious consequences, unless some means can be devised to put a stop to them. The interest, which is becoming daily more extended and lively, in sanitary matters, the atten-

tion which the subject receives from the press, from medical bodies, and from special associations and conventions, encourage those who know the need of action in this matter, to hope that something is really about to be accomplished, by the force of an enlightened public opinion, towards organizing an adequate means for the protection of the health and lives of the people against all the preventable causes which injuriously affect them.

While the subjects of ventilation, drainage, pure water, suitable dwellings for the poor, quarantine, and other means of preventing contagious diseases, etc. etc., deservedly occupy a great share of attention, the matter of pure food is second to none of them in essential or immediate importance. It has not, perhaps, attracted its due share of notice, because the danger has not been so apparent. While an indefinite feeling of distrust and fear has prevailed with regard to the purity and wholesomeness of many articles of diet, no investigations have been attempted, or at least made public, with the view of settling definitely just what the extent and nature of the evil is, and what progress it has made in this country. The labors of Dr. Hassall in England, which I have made the basis of my own experiments, and unguided by which it would have been impossible for me to have accomplished any thing satisfactory without a greater share of means

and time than I could have devoted to the subject, have aroused the English nation to the dangers of these nefarious practices, and a struggle is now going on between the public and their poisoners, the result of which appears yet uncertain. But Dr. Hassall's works are large and costly, and having never been republished in this country, are accessible here to but few. Moreover, they contain much matter of merely local consequence, which, most interesting and important both to the government and people of Great Britain, has no application in the United States.

I have tried, in this brief treatise, to supply in some degree at least, the want to which I have alluded. I have described the frauds which I have found actually to exist, and so far as it was possible, I have pointed out the means by which they can be detected or avoided. But this is not all that is required, nor all that the public have a right to expect. We are protected by laws against direct fraud and poisoning, but this daily attack which we suffer upon our pockets and our lives, goes on almost with impunity.

We often hear the remark that we are governed too much, and there are indubitably a vast number of laws upon our statute-books which are not, and cannot be enforced. It is not desirable to add to their number. But there are also many laws which

are promptly and efficiently executed; not, to be sure, effectual in entirely suppressing the evils against which they are directed, for this cannot be expected; but keeping them in check, and adequately punishing offenders.

A careful investigation of both these classes of enactments, will give some clue to the causes which destroy the usefulness of the first, and to those which secure the efficiency of the last.

Before going further, however, I would remark, that I offer these suggestions with great diffidence, well aware that the practical difficulties of the subject are worthy the care and thought of far abler men than myself, and if I venture to throw out some ideas upon the subject, it is more with the view of stimulating thought thereon, than of insisting upon any specific plan for effecting an object, the accomplishment of which cannot fail to be regarded by all good citizens as of great importance.

These appear to be the requisites of a law, without which it is useless to hope for any great benefit to arise from its enactment. *First*, it must be *necessary*, and felt by the public generally to be so; *Second*, it must be *just* in all its provisions, that no public sympathy with offenders unfairly condemned, or too severely punished, may bring it into odium; *Third*, it must be the specific duty of some fairly

paid and competent official to see it executed, and all of its provisions carried out; *Fourth*, and perhaps most important of all, it should be drawn by able and honest men, acquainted with all the tricks and quibbles by which many of our best laws are rendered practically inoperative.

The necessity of laws regulating the manufacture and sale of alimentary substances can only be impressed upon the public through the press, by publications in which they may feel confidence that the sole object is the public good, unmixed by partisanship, the desire of gain through temporary excitement, or the propagation of pet schemes of philanthropy. These publications must have not only a scientific, but a broad and impartial basis; and, while no compromises should be made with fraud, no attempts should be made to excite personal prejudice or vindictiveness. Many are engaged in these deceptions through carelessness, some through ignorance, and more through a feeling of necessity which has some apparent foundation in the active competition of trade. The majority of these would willingly abandon their dangerous practices if they could be convinced that they might do so without serious loss. When, too, they see that others are daily inflicting upon *their* families injuries similar to those which they practise themselves upon others, a selfish feeling of alarm is aroused, and they would

be willing to surrender their own illgotten profits, if in return they might be insured security from like dangers. These crimes have become so extensive that no one is safe, and the robber is robbed, and the poisoner is poisoned by the very ones whom he congratulates himself upon having profited out of through like processes.

Mr. Wakley, the publisher of the *London Lancet*, ventured upon the dangerous expedient of not only publishing the results of Dr. Hassall's investigations, but also the names of those of whom the articles examined were purchased. The excitement which such a course would produce in a city of legalized abuses and monopolies like London, can scarcely be imagined; but the most conclusive testimony to the perfect honesty and accuracy of Dr. Hassall's statements, is borne by the fact, that notwithstanding hundreds of names of men who had been supposed to be the most honest and respectable tradesmen and merchants in London were thus held up to public scorn, but one suit for libel was ever commenced, and this was withdrawn before trial, without any acknowledgment of error on the part of Dr. Hassall or the *Lancet*. These men, grown rich and secure, by long immunity, when the covering was stripped from their guilty practices, and the light of truth "from a quarter-inch lens" thrown upon their doings, raved and raged like wild beasts; but their

exposer was so protected by the truth and accuracy of his statements that all their malice, not only unable to harm him, served but to raise him higher in the public esteem.

Mr. Leslie, the proprietor of *Leslie's Illustrated Newspaper*, published in New York, pursued a similar course with regard to the abominable wickedness practised in the milk business in that city, with like results.

While I have no wish to condemn the course which these two gentlemen have seen fit to take, in which they were justified by the public voice, and which has doubtless been of use in making such important facts generally known, it seems to me that the efforts of the press alone, in this direction, are an entirely insufficient protection to the public. While the articles to which I allude doubtless helped the circulation of the periodicals in which they appeared, I believe they have done no permanent good to the cause of pure food; but the contrary, by leading to a reliance upon the terror of public exposure, rather than upon the laws, for protection. How feeble and inefficient such protection must be, is plain to all. All publications of this kind create an excitement which is necessarily temporary, and as soon as they cease to interest the public and promote the sale of the paper which printed them, they are discontinued, and in a little while things are as

bad as ever. Besides, except in very rare cases, it is not the duty nor the right of the press to inflict punishment upon criminals, either suspected or convicted. Public indignation, thus excited, is almost always excessive and undiscriminating, and therefore necessarily unjust. To the laws alone, wisely framed and honestly executed, should we appeal for relief. Whatever may be said to the contrary by those who practically deny the power of a free people wisely, efficiently, and honestly to conduct their own affairs and protect social rights and order, no believer in the principles upon which the American theory of government is based, has a right to say that there is no use in trying to regulate these matters here by law. European governments do it, and do it effectually; not only imperial France, but democratic Switzerland, and why not America? It is certainly worth while to try.

It is of particular importance that a general law for the suppression of adulteration of food and medicine, should be just, and that its justice should be recognized both by the public at large, and by those whose business and interests will be more immediately affected by it. For this reason it would seem best that a public analyst should be appointed, either by the city or State, or conjointly by both, whose duty it should be to test, for a moderate fee, not to exceed the actual cost of the chemicals used

in the process, any sample of food or drink sent to them by a dealer therein, and to give a certificate of the result. Thus no man need be deceived in the quality of the goods which he purchases, and may be justly and rigidly held accountable for the purity of those which he sells. It should then be the duty of the analyst, frequently to purchase, or cause to be purchased, at the various shops and stores throughout the city, samples of goods which are commonly adulterated. A careful record of these purchases should be made at the time, and they should be bought in the presence of a witness. They should then be accurately tested, and, if found impure from adulteration, the proper action taken against the vender.

The fine for a first offence should be moderate, but for incorrigible offenders, even imprisonment would not be too severe. In Pennsylvania, a debt contracted for liquors, which prove to be adulterated, is uncollectable by law. I do not know of any objection to extending this provision to all adulterated articles.

The proper performance of the duties of a public analyst would require for the post a man of high character and acquirements, whose whole time should be given to the duties of his office. Indeed, if fully carried out, they would probably require the

coöperation of a number of assistants; but as his laboratory would be a most excellent school of practical chemistry and microscopy, no difficulty would be experienced in obtaining such aid without cost to the public. The possession of such a laboratory, by the city or State, would be of great service, and save much expense in cases of suspected poisoning, etc. It might even be extended to the analysis of soils, manures, minerals, and other substances, where such an analysis would be of public utility. The expense, in comparison with the benefits of such an institution, would be extremely trifling: indeed the money paid for analyses in poisoning cases, would go far toward making up the whole annual outlay.

The law should be drawn with care, knowledge, and deliberation. In the first place, a correct definition should be given of what constitutes adulteration. "It consists in the intentional addition to an article, for the purposes of gain or deception, of any substance or substances, the presence of which is not acknowledged in the name under which the article is sold." This is Dr. Hassall's definition, and it could hardly be bettered. I was much amused, and withal instructed, not long since, by an account which the worthy milk inspector of Boston gave me of his troubles in attempting to enforce the very loosely drawn milk act. Notwithstanding his utmost

endeavors, and the most convincing evidence, he says the milkmen "will get away from him" through some ingenious legal quibble. He was quite indignant that one distinguished lawyer, who he says was a prime mover in having the act passed, should use his legal subtlety in clearing clients from the penalty of its infringement.

One provision of the law requires that the name of the milkman shall be *legibly* placed upon his wagon. The court has decided that if the letters are visible to the naked eye, they are *legible* within the meaning of the act. Other flaws of like character might be named, and indeed the famous coach-and-six can be driven through any part of this law with unusual facility. We mention this to show the truth of the saying, that "what is worth doing, is worth doing well," and that a good law may be rendered valueless by being unskilfully drawn.

The English Parliament has recently passed a Bill for the Prevention of Adulteration, after efforts persevered in for three sessions; but, no doubt by the influence of interested parties, the law has been so framed as to offer but a feeble protection where there was need of the most active and vigorous measures. The Cornhill Magazine for July, 1860, has an article in which the faults of this law are discussed. I make use of an extract which will serve to show the nature of the modifications which

have been made in it, at the instance of its enemies, to destroy its usefulness.

"In the first place the bill is entirely permissive; nobody is compelled to do any thing whatever under it: and should the vestries, district boards, and other local authorities in whom the power of appointing analysts is vested, so determine, it may remain a dead letter: a result, in most cases, highly probable: for it is hardly to be supposed that these vestries, composed as in great part they are, of tradespeople, will be desirous of carrying out the bill efficiently.

"Secondly, it is to be observed, that its operation is confined to articles of food and drink: it does not include drugs, although the prevention of the adulteration of these is of the utmost consequence. To reduce the strength of a medicine by adulteration — the doses of medicines being fixed quantities, determined by careful observation and experiment, and the amount of adulteration being indefinite — is to introduce into the practice of medicine the greatest uncertainty and confusion. If, affirms an able writer, we could possibly eliminate from the mass of human disease that occasioned by the constant use of deleterious food, we should find that it amounted to a very large percentage of the whole, and that one of the best friends of the doctor would prove to be the adulterator. But even our refuge fails us in the hour of need, when the tools of the medical man, like those of the sappers and miners before Sebastopol, often turn out to be worthless.

"Further, its application is hampered by certain restrictions which will go far in practice to render it inoperative.

"It applies—

"1st. To the sale of articles which, to the knowledge of the seller, are adulterated in such a way as to be injurious to health.

"2d. To the sale of articles expressly warranted as pure and unadulterated, which are adulterated and not pure.

"The precise words of the clause are: 'Every person who shall sell any article of food or drink, with which, to the knowledge of such person, any ingredient or material injurious to the health of persons eating or drinking such article has been mixed; and every person who shall sell, expressly warranted as pure or unadulterated, any article of food or drink which is adulterated or not pure, shall for every such offence,' etc.

"It will be evident, on an attentive consideration of these words, that, under the bill, articles may (and doubtless will) be sold with impunity, which are adulterated in a manner injurious to health, in those cases where knowledge of the adulteration cannot be established. It will also be apparent that articles will still be sold which are adulterated and not pure; there being no restriction whatever on the sale of such articles, provided they are not expressly warranted.

"Thus, under the bill, ample opportunity will be afforded for the practice of adulteration. Mixtures of all kinds may still be sold without let or hindrance, if not warranted; and this although the names under which they are sold do not convey any intimation of their compound character. Regarded from one point of view, the measure actually legalizes the sale of mixed articles, when not warranted; that is, under certain circumstances, it affords a legal sanction to the perpetration of adulteration, and the consequent robbery of the public.

"The restrictions to which we have referred, as impairing greatly the chances of any benefit to the public from the bill, are various.

"In the case of the sale of articles adulterated in a manner injurious to health, *knowledge of the fact* on the part of the seller must be proved. Now, in the majority of cases, it will be impossible to produce legal evidence of this knowledge; so that this kind of adulteration will still continue to be practised to a great extent, and that with absolute impunity.

"A second restriction is, that in the absence of a warranty, any non-injurious mixture may be sold: now it is chiefly through the sale of such mixtures that so much fraud is committed.

"These distinctions are wholly unnecessary, while they go far, as already stated, to deprive the bill of any value it may possess. The sale of an adulterated article without knowledge on the part of the seller, and without express warranty, ought to be sufficient to constitute an offence under the bill: the knowledge of the fact, or its absence, ought merely to make a difference in the degree of the offence, and in the extent of the consequent punishment.

"The words 'expressly warranted,' were introduced in order to permit the unrestrained sale of such mixed articles as cocoa and mustard. If they did this, and nothing more, not much harm would be done: but, indirectly, they legalize all those adulterations which consist in the mixture of a cheaper non-injurious substance with a dearer article, under the name of which such mixture is usually sold; a practice that constitutes the great profit of adulteration as heretofore carried on.

"Now, in place of departing from right principle in order to meet the exceptional cases of cocoa and mustard, the proper course would have been to alter the names of those mixed articles so as to render apparent the fact that they are really mixtures, and not as the names now used imply, that they are composed wholly of cocoa and mustard. This could have been done readily enough, and without injury to the trade of those engaged in the manufacture of such articles. Thus the article now called mustard, and which consists of wheat flour, turmeric, and mustard, in many varying proportions, might be sold as what it really is, under the name of 'mustard condiment;' and the various preparations vended as cocoa, granulated, dietetic, homœopathic cocoa, etc., might be sold with the addition of the word 'mixture,' or by substituting the word 'chocolate,' which is known to be a compound article for cocoa: *e. g.* 'granulated cocoa mixture, granu-

lated chocolate,' 'dietetic chocolate,' and so on. Were these alterations made, these compound articles might have been warranted under the bill, which cannot now be done. The true course was to have left the manufacturers of these articles to conform to the law, and not to have altered the law to suit them: especially to the injury of the public. The earlier bills introduced into the House of Commons did not contain any such concession.

"Other restrictions are to be found embodied in the second clause of the bill, which provides that the purchaser shall give notice to the seller or his servants, of his intention to have the articles purchased analyzed, and shall also afford him the opportunity of accompanying the purchaser to an analyst appointed under the act, in order to secure such article from being tampered with. The first condition is reasonable enough, but the second borders upon the absurd. With such a provision as this, the chances of prosecution under the act are but few. Supposing an analyst to be appointed for a large district or for a whole county, the seller and the purchaser, perhaps a timid woman or a nervous man, would have to travel in each other's company some ten or twenty miles, as the case might be. Fancy what an agreeable journey, and how amicable the conversation by the way! Surely such cases might be left to be proved by the ordinary rules of evidence: the witnesses are examined on oath; and it is not more likely that they would perjure themselves in a case of adulteration than in any other case. It was scarcely possible to have adopted any provision more calculated than this to destroy the efficiency of the bill.

"The punishments for adulteration consist, for the first offence, in the infliction of a fine of not less than five shillings nor more than five guineas; for the second offence, it is rendered lawful for the justices to publish the name, place of abode, and offence, of the person convicted of adulteration.

"The opinion has already been expressed that fines are insufficient to meet the evil, and certainly such small fines as those named in the bill will do but little good. Of what avail will it be to fine a manufacturer, who sells his tons of adulterated goods weekly, five shillings or five pounds? The man who gets drunk is fined five shillings, ought the fraud involved in the practice of adulteration to receive no greater punishment? The Wine Licences Bill contains a more efficient provision than this. It provides for the infliction of a fine of not less than ten pounds or more than twenty pounds on any person who shall fraudulently dilute or in any way adulterate such wines as he may sell; and this for a first offence, while for a second the license to sell is altogether suspended for five years.

"Nothing can be more appropriate, and, it may be added, more efficient than the punishment provided for second offences; and much good might have been expected to have resulted from it, had the other provision of the bill been of a less feeble character; but considering the nature of the bill altogether, there is much reason to fear that the penalty for second convictions will rarely if ever be inflicted.

"Such are the chief provisions of the 'Adulteration of Food and Drink Bill.' A few others may be very briefly noticed. The complaints are to be heard by magistrates, and to be disposed of by summary conviction before two justices of the peace, with a right of appeal to Quarter Sessions. The purchaser of any article of food may have it analyzed, where any analyst has been appointed under the bill, on payment of not less than two and sixpence, or more than ten and sixpence. Lastly, justices may order articles to be analyzed, on complaint being made, by any skilled person whom they may appoint. This is a very excellent provision, because it is evident from it that the purchaser may at once make his complaint before the justices, whether an analyst

has been appointed or not, and the justices may at their own discretion order the analysis of the suspected article.

"One very great defect in the bill is the absence of any provision authorizing the appointment of a central authority for the regulation of the whole subject; for reference in doubtful or disputed case; and for the issuing of general instructions.

"Neither does the bill define what constitutes injurious adulteration; it has left this an open question, which, in the event of prosecutions under it, will occasion endless diversity of opinion, and give rise to much litigation."

Such are some of the beacons which the experience of the friends of pure food elsewhere offers, to guide the actions of our own legislatures. The enactments of France, Belgium, and Switzerland, which work effectually, should also be consulted by those upon whom the duty may devolve of drafting laws applicable to the matter in this country. No amount of careful study and deliberation would be wasted which was directed to the end of so tempering and fortifying the needed laws, that no injustice should be done, and yet no criminal escape. Absolutely to reach that end, may perhaps be impossible, but a reasonable approach to it is, I am convinced, if not an easy, at least a practicable task.

Before closing this, my first, rather unexpected, and probably my last adventure in book-making, it only remains to me to express my thanks for the kind attention of the reader who has accompanied me to the end, and to hope that, in some slight

degree at least, what I have written may be serviceable to my fellow-citizens, whom it is my wish, as it is my professional duty, to serve to the best of my ability in all that relates to the public health, so greatly endangered by the abuses which I have described.

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